THE Petroleum Engineer

MAY 1935

VOLUME VI NUMBER VIII

A MAGAZINE OF METHODS FOR OPERATING MEN

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# Meetings

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American Petroleum Institute, Production Division—June 5 and 6, William Penn Hotel, Pittsburgh, Pennsylvania.

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Independent Petroleum Association of America, Annual Meeting—November 4 and 5, Adolphus and Baker Hotels, Dallas, Texas.

American Petroleum Institute, Sixteenth Annual Meeting—November 11, 12, 13, and 14, Biltmore Hotel, Los Angeles, California.

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LOS ANGELES, CALIF.

C. Morris

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# The Course of Oil

By K. C. SCLATER

**Symposium on Motor Fuel**

At the fourteenth annual convention of the Natural Gasoline Association of America held in Tulsa last month, a full day's session was devoted to a symposium on motor fuel volatility trend and its possible effect on automotive design and performance. Prominent members of the automotive industry, the refining industry, and the natural gasoline industry took an active part in the discussion of this important question. The active part taken by automotive designers in expressing their views and exchanging opinions augurs well for the ultimate success of this innovation.

Since an engine must be designed for the fuel it will be required to consume, the automotive designer has a vital interest in anything pertaining to automotive fuels. Likewise, the manufacturer of automotive fuels has a vital interest in any developments concerning automotive design. If each has some familiarity with the other's difficulties it will be easier to arrive at a solution of their mutual problems.

Automotive designers suggested classifying automotive fuels on their volatility as well as on their antiknock properties. Their reasons for making this suggestion were fully covered when they explained the difficulties confronting them. It was observed during this discussion that motor fuels were discussed from a much broader viewpoint than might have been the case had members of the automotive industry not been present.

This meeting marks a coöperative effort between two great industries that, it is hoped, will develop into an annual forum for automotive designers and motor fuel manufacturers for the discussion of their mutual problems.

**Reservoir Energy and Proration**

W. N. Lacey of the California Institute of Technology, in discussing the relation of research to some production problems at the Pacific Coast district meeting of the A.P.I. last month, had this to say: "Since reservoir energy is one of the vital requisites in the recovery of oil, it should be subject to proration as much as the hydrocarbons themselves. Energy reserves can be tapped across property lines and out of proportion to the equities, and one of the responsibilities of proration is to afford protection in this regard."

**Depth and Speed**

One well, the progress of which is being closely followed by the entire industry, is the Gulf Production Company's well, McElroy 103, in West Texas. At this writing (May 10) the well is 12,664 feet deep—the greatest depth yet reached by any well. The great depth attained in this well is not due to a combination of fortuitous circumstances but rather to the skill and intelligence exercised in every operation and move made in connection with the drilling. It is a tribute to men and materials.

Another record worthy of note is the speed made recently in drilling a well in the Bosco field, Louisiana. This well was drilled to a depth of 1490 feet in the first eight hours after it was spudded. Surface casing was set at 1235 feet. About five and a half days later, or six days from the time the well was spudded in, a depth of 6790 feet had been reached.

Both are notable records of their kind.

**Progress in Directional Drilling**

Remarkable progress is being made in extending the application of controlled directional drilling methods to the solution of difficult drilling problems. Consider the fact that a well can be deflected successfully more than two hundred and fifty feet horizontally per thousand feet of depth. What does this mean? Just this: many sands known to be productive that underlie inaccessible locations at the surface, such as a river or a body of deep water, can be successfully penetrated with the drill at any desired point.

Edge wells that have been drilled into water can be deflected into the oil-bearing section of the sand.

A recent successful application in the Gulf Coast is the drilling of overhanging salt dome fields. If the overhang is missed the hole may be deflected into the oil sand by controlled directional drilling methods.

It is sometimes necessary to drill through great thicknesses of heaving shale to reach the oil sand by straight-hole drilling methods. Often these great thicknesses of heaving shale can be avoided by changing the surface location and employing controlled directional drilling methods.

These applications are significant as showing the vast possibilities of this adaptation of oriented whip-stocking drilling practice.

# « « « HIGHLIGHTS IN OILDOM » » »

## Bill Governing Gas Wastage Passed

A gas bill designed to prevent the enormous wastage of gas in the Panhandle field of Texas has been passed by both branches of the legislature, signed by the governor, and become law. The outstanding features of the new law are that sweet gas can be used for light and fuel only, still permitting the use of sour gas for carbon black manufacture; and waste of either sour or sweet gas by blowing it into the air after it has been stripped of its gasoline content is definitely forbidden.

Briefly the major provisions of the bill are as follows:

Sweet gas may be used only for the following purposes: Light or fuel; efficient chemical manufacturing other than the manufacture of carbon black; bona fide introduction of gas into oil- and gas-bearing horizons in order to maintain or increase the rock pressure or otherwise increase the ultimate recovery of oil or gas from such horizons; the extraction of natural gasoline therefrom when the residue is returned to the horizon from which it is produced.

Sour gas may be utilized for the same purposes, and in addition for the manufacture of carbon black provided it is utilized in a plant producing a recovery of not less than one lb. of carbon black to each 1000 cu. ft. of gas, and provided further that the gasoline content is removed and saved from such sour gas before it is utilized for carbon black.

Gas, both sweet and sour, may be used for gas-lift, provided the gas-oil ratio does not exceed 10,000 cu. ft. per bbl. unless especially permitted by the Texas Railroad Commission. When such a permit is issued the gas used in excess of 10,000 cu. ft. per bbl. must be stripped and the residue burned for carbon black.

The bill further provides that during January and July of each year gas well operators are required to test their wells to determine the open flow and rock pressure, and a report of these tests must be filed with the railroad commission.

●

## 1025 East Texas Wells Producing Artificially

A recent report of the Engineering Committee of the East Texas field reveals that on January 1 there were 1025 wells in the field being produced by artificial means. This figure represents 6.61 per cent of the total number of producing wells in the field on that date. On January 1, 1934, the percentage of pumpers was 4.98, showing a 1.63 per cent increase in pumping wells during the year of 1934.

On January 1 of this year there were 3554 wells out of a total of 15,507 (22.92 per cent) that were equipped for artificial lift, but only 1025 of the 3554 wells were using the pumping or gas-lift installations.

More wells were placed on artificial lift during the second half of 1934 than during the first half. During the first half of 1934, 153 wells were placed on artificial lift; and during the second half, 280 wells were added to the list of those artificially produced.

●

## Oklahoma Law Provides 10-Acre Spacing

A new law just passed by the Oklahoma legislature provides that no well may be drilled on a tract of less than ten acres unless 80 per cent or more of the owners, controlling 80 per cent or more of the acreage, agree to a different spacing.

## Oklahoma Proration Tax Bill Signed

When Governor Marland of Oklahoma signed House Bill No. 188 it assured that the oil industry of the state will support the proration department for two more years, and also the state's participation in the oil states compact program. The bill extends two years, or until June 30, 1937, the proration tax of one-eighth cent a barrel on crude oil produced in the state. Under the terms of the new law seven-eighths of the revenue goes to the proration fund for upkeep of the proration department, with the remaining one-eighth going into a special fund to pay for the Oklahoma setup and participation in the oil states compact program.

●

## Supreme Court Rejects Certificate in Wilshire Case

The United States Supreme Court has rejected a certificate from the Ninth Circuit Court of Appeals asking for a ruling on points raised in the California oil cases, involving the Wilshire oil group, thus refusing to give a decision in advance of the rendition of definite decisions by the lower courts. The Wilshire oil group appealed from a preliminary injunction of the California Federal District Court restraining them from producing crude petroleum in excess of their allocations under the oil code. The Ninth Circuit Court of Appeals certified to the United States Supreme Court two questions going to the heart of the question of validity of the industrial recovery act, asking whether it had the power on an appeal from the interlocutory order to decide the question raised by the producers on the "total absence of a cause of action."

In dismissing the questions the Supreme Court said that, apart from the "objectionable form of the certified questions, which are not aptly or definitely phrased," in its opinion the question before the Court of Appeals is whether the district court abused its discretion in granting an interlocutory injunction; that the Court of Appeals is not bound to decide, upon the allegations of the bill, an important constitutional question, as to which the Court of Appeals is in doubt, in advance of an appropriate determination by the district court of the facts of the case to which the challenged statute is sought to be applied. Nor should the Supreme Court undertake to determine the constitutional validity of the statute upon such questions as those that have been certified, said Chief Justice Hughes.

●

## Gasoline Consumption Up in 1934

Consumption of gasoline in the United States during 1934, totaling 16,595,180,000 gallons, was the second largest in history, being exceeded only by 1931 when the total reached 16,628,880,000 gallons, according to figures released by the American Petroleum Institute's Department of Statistics.

New York retained its place as the largest gasoline-consuming state, the 1934 consumption being 1,577,019,000 gallons. Second largest consumption was reported by California, 1,334,177,000 gallons, and Pennsylvania was in third place with 1,136,344,000 gallons.

AXELSON
Steel and genuine Reading Wrought Iron Sucker Rods—Working Barrels

•

BEAUMONT IRON WORKS COMPANY
Rotary and Pumping Equipment

•

BLAW-KNOX COMPANY
Gas Cleaners—Steel Grating—Tracifiers

•

DONOVAN BOILER WORKS
Oil Country Boilers

•

JONES & LAUGHLIN STEEL CORPORATION
Tubular Goods

•

LINEAR PACKING AND RUBBER CO., Inc.
Packing for all needs

•

NATIONAL TRANSIT PUMP AND MACHINE CO.
Steam Pumps—Compressors

•

RAYBESTOS-MANHATTAN, Inc.
Raybestos Rotary Brake Lining

•

READING IRON CO.
Wrought Iron Tubular Goods

•

JOSEPH REID GAS ENGINE COMPANY
Gas and Diesel Engines

•

REPUBLIC RUBBER CO.
Transmission and Conveyor Belting —Mechanical Rubber Goods

•

JOHN A. ROEBLING SONS' COMPANY
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# FRICK-REID

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2—Convenient Store Points with adequate stocks, backed by prompt mill and factory shipments.

3—Trained, courteous, able men.

•

GREETINGS
Natural Gasoline Association, Tulsa Convention.
American Petroleum Institute, Tulsa Mid-Year Meeting.
Natural Gas Association, Memphis Convention.

•

# FRICK-REID
## SUPPLY CORPORATION

Pittsburgh, Pa. Tulsa, Okla.

# LATEST ACTIVITIES IN THE OIL FIELDS

WHAT may prove to be one of the most important Kansas discoveries in several years is the finding of production in the Topeka lime in the Gorham area of Russell County. This is the first commercial production from that horizon in the state. The discovery well was Hartman and Blair's No. 1 Rouback, drilled to 2790-95 ft., and producing 4076 bbl. of oil on a 24-hour test.

•

The Peay Oil Company's No. 1 Denio Mining and Milling Company test in Big Horn County, Wyoming, flowing ten bbl. of 48-deg. gravity oil hourly from the Peay sand, is considered one of the state's major light oil strikes of the last four years, as it opens up several thousand acres, hitherto untested, that is blocked off from the Garland field proper by a fault. The well is drilled to a total depth of 3223 feet.

•

The Playa del Rey extension of the old Venice field within the city limits of Los Angeles, California, gives promise of being more than a mere extension and developing into a sizable field. New wells are being brought in, some with production of 5000 bbl. a day. Chas. W. Fourl, who proved up the area, recently completed his third well, making 5000 bbl. of 22 gravity oil from a total depth of 6545 feet. Other wells have been completed in the area, and several are nearing completion.

•

At the latest report The Gulf Production Company's No. 103 McElroy in Upton County, Texas, the world's deepest test, was coring ahead at 12,583 ft. in gray and brown lime. Production is being sought in the Ellenberger member of the Ordovician lime series.

The Texas Company's No. 1 Bayou St. Denis in Jefferson Parish, Louisiana, if successfully completed, will open the deepest oil field in the Gulf Coast area. It showed 2500 ft. of oil on a 15-minute drill stem test made through ¾-in. chokes. The well is drilled to a total depth of 9572 feet.

•

Lee and Estill counties, Kentucky, are the scene of considerable excitement. Several wells have been completed in the area, two and one-half miles northwest of the Big Sinking field, and there are 11 strings of tools in operation. Geologists and engineers consider it the best prospect for a good oil pool found in eastern Kentucky in 14 years. The wells produce anywhere from 15 bbl. to 100 bbl., averaging about 50 bbl. daily.

•

Midway between Edmond and Guthrie in Logan County, Oklahoma, the Sinclair-Prairie and others No. 1 Koetisch opens a new pool. After being shut in overnight it flowed an estimated 95 bbl. in 14 minutes. The showing is from the second Wilcox sand, encountered at 6322-32 feet.

•

The Plymouth Oil Company's No. 1-C Welder, ten miles northeast of the town of Sinton, opens a new pool in San Patricio County, Texas. Initial production was 11 bbl. of 35 gravity oil per hour through a ⅜-in. choke. The well cored sand at 5501-03 ft., and is drilled to a total depth of 5508 feet.

•

Bee County, Texas, is the scene of another wildcat strike. Two miles northeast of the Grayburg field the Worth Oil Company's No. 1-A Rutledge has been brought in flowing an estimated 25,000,000 cu. ft. of gas and 150 bbl. of oil daily through ½-in. choke. The well is producing from the Pettus sand at 3386-94 feet.

## AVERAGE CRUDE OIL PRICES

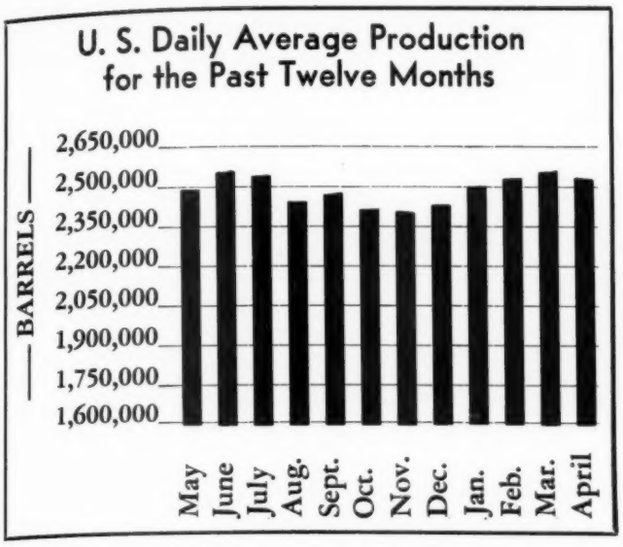
| | | | |
|---|---|---|---|
| California | | Louisiana | |
| Playa Del Rey | $ .90 | North Louisiana | $ .95 |
| Coalinga | .81 | Gulf Coast | 1.04 |
| Signal Hill | 1.12 | Illinois | 1.13 |
| Montana | 1.35 | Kentucky | 1.08 |
| Wyoming | 1.00 | Indiana | 1.12 |
| Colorado | 1.00 | Ohio | |
| New Mexico | .75 | Lima | 1.30 |
| Texas | | Michigan | 1.02 |
| North Central | .95 | Pennsylvania | |
| Panhandle | .51-.71 | Bradford | 2.35 |
| West Texas | .70-.75 | Southwest | 2.02 |
| Gulf Coast | 1.04 | Eureka | 1.97 |
| Darst Creek | .87 | Buckeye | 1.87 |
| East Texas | 1.00 | Corning | 1.32 |
| Kansas | 1.00 | West Virginia | 1.67 |
| Oklahoma | 1.00 | Canada | 2.10-2.17 |
| Arkansas | .70 | | |

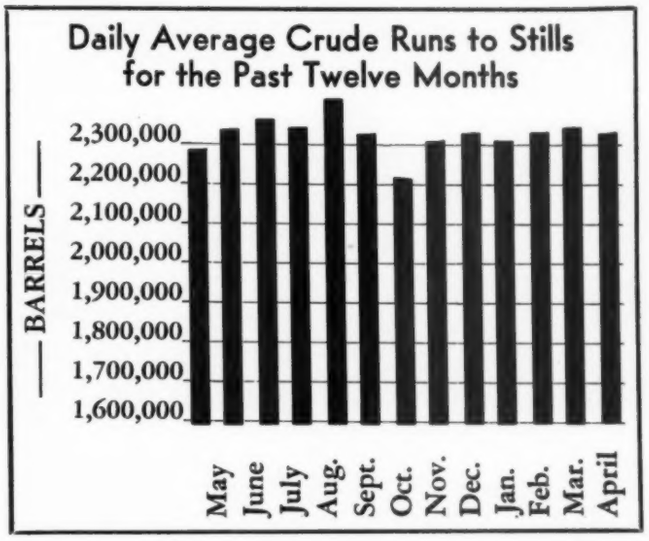
## DAILY AVERAGE CRUDE OIL PRODUCTION

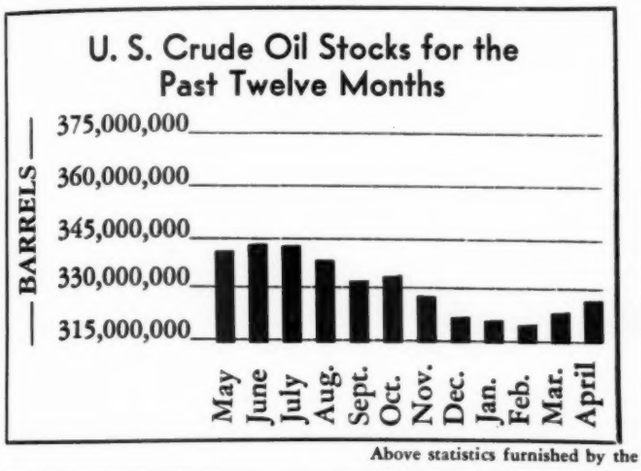
Furnished by A.P.I.

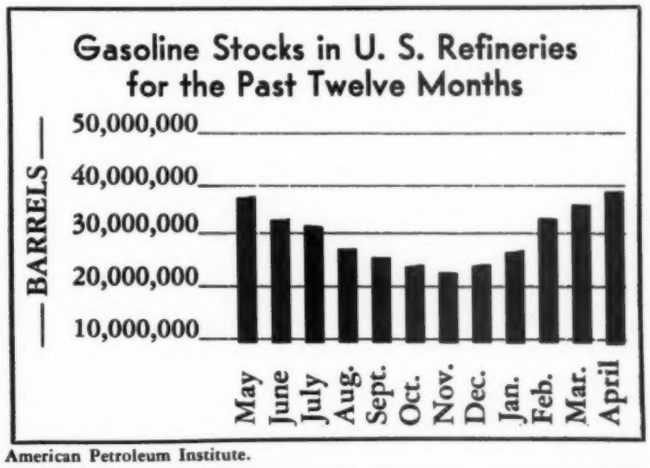
(Figures in barrels)

| | Federal Agency Allowable Effective April 1, | Week Ended April 27, 1935 | Week Ended March 23, 1935 | Week Ended April 28, 1934 |
|---|---|---|---|---|
| Oklahoma | 493,300 | 522,750 | 514,550 | 532,350 |
| Kansas | 141,000 | 146,000 | 153,050 | 129,900 |
| Panhandle Texas | | 61,650 | 65,050 | 58,750 |
| North Texas | | 58,450 | 57,600 | 55,950 |
| West Central Texas | | 23,300 | 25,750 | 26,350 |
| West Texas | | 152,950 | 152,900 | 138,350 |
| East Central Texas | | 48,800 | 52,400 | 48,900 |
| East Texas | | 443,600 | 446,100 | 462,150 |
| Conroe | | 43,300 | 47,700 | 50,050 |
| Southwest Texas | | 62,400 | 60,250 | 48,900 |
| Coastal Texas (Not incl. Conroe) | | 138,100 | 134,250 | 113,450 |
| TOTAL TEXAS | 1,021,000 | 1,032,550 | 1,042,000 | 1,002,850 |
| North Louisiana | | 22,900 | 23,050 | 25,900 |
| Coastal Louisiana | | 101,450 | 95,050 | 49,000 |
| TOTAL LOUISIANA | 111,000 | 124,350 | 118,100 | 74,900 |
| Arkansas | 30,700 | 30,200 | 30,800 | 30,500 |
| Eastern (Not incl. Michigan) | 106,900 | 108,450 | 107,800 | 97,650 |
| Michigan | 32,700 | 40,900 | 36,900 | 27,100 |
| Wyoming | 34,300 | 33,100 | 33,000 | 30,200 |
| Montana | 9,700 | 10,450 | 10,300 | 6,950 |
| Colorado | 3,700 | 5,000 | 4,950 | 2,600 |
| TOTAL RK. MT. ST. | 47,700 | 48,550 | 48,250 | 39,750 |
| New Mexico | 49,700 | 50,350 | 47,050 | 45,450 |
| California | 493,300 | 457,300 | 501,600 | 469,800 |
| TOTAL U. S. | 2,527,300 | 2,561,400 | 2,600,100 | 2,450,250 |




Above statistics furnished by the American Petroleum Institute.

## Summarized Operations in Active Fields for April, 1935

| Fields | Completions | Producers | Rigs | Drilling Wells | Depth of Production | No. Casing Strings | Gravity of Oil | Type of Tool Used |
|---|---|---|---|---|---|---|---|---|
| **Texas** | | | | | | | | |
| East Texas | 405 | 399 | 86 | 244 | 3600 | 2 | 40 | Rotary |
| Duval County | 24 | 13 | 2 | 12 | 2300 | 2 | 22 | Rotary |
| Archer County | 83 | 56 | 20 | 45 | 660–1800 | 1 or 2 | 40 | Rot.-Cab. |
| Conroe | 6 | 6 | 1 | 2 | 2000–7400 | 3 or 4 | 40 | Rotary |
| Refugio County | 10 | 9 | 6 | 11 | 5200 | 2 | 38 | Rotary |
| **Oklahoma** | | | | | | | | |
| Oklahoma City | 6 | 5 | 6 | 22 | 6500 | 3 | 39 | Rotary |
| Pontotoc County | 20 | 18 | 8 | 60 | 1800–4488 | 2 or 3 | 38 | Rotary |
| Osage County | 24 | 17 | 22 | 48 | 380–2850 | 2 | 37.5–40 | Rot.-Cab. |
| **Kansas** | | | | | | | | |
| McPherson County | 6 | 5 | 2 | 16 | 2900–4300 | 2 | 38 | Rot.-Cab. |
| Harvey County | 5 | 5 | 1 | 7 | 3450 | 2 or 4 | 37 | Rot.-Cab. |
| Ellsworth Arch | 68 | 56 | 32 | 131 | 3300 | 4 | 37 | Rot.-Cab. |
| **California** | | | | | | | | |
| Kettleman Hills | 2 | 2 | 3 | 24 | 8300 | 3 or 4 | 40 | Rotary |
| Long Beach | 9 | 9 | 8 | 34 | 7000 | 3 | 36 | Rotary |

## Field Activities by States for April, 1935

| State | Completions | | Producers | | Locations | | Rigs | | Drilling Wells | | Production, 1934 (In Barrels) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | April | March | April | March | April | March | April | March | April | March | |
| Arkansas | 11 | 11 | 2 | 4 | 7 | 14 | 10 | 20 | 44 | 47 | 11,412,100 |
| California | 55 | 64 | 52 | 59 | 77 | 96 | 87 | 83 | 224 | 205 | 175,678,362 |
| Colorado | ... | 2 | ... | 2 | .... | .... | 2 | 2 | 30 | 24 | 1,168,000 |
| Illinois | 2 | 4 | 2 | 1 | .... | .... | 1 | 10 | 8 | 12 | 4,466,000 |
| Indiana | 12 | 6 | 8 | 4 | .... | .... | 2 | 1 | 35 | 30 | 813,000 |
| Kansas | 124 | 98 | 100 | 71 | 83 | 101 | 40 | 63 | 191 | 197 | 45,577,050 |
| Kentucky | 20 | 4 | 19 | 3 | .... | .... | 5 | 2 | 12 | 17 | 4,863,000 |
| Louisiana | 72 | 48 | 45 | 34 | 92 | 61 | 39 | 55 | 153 | 145 | 32,572,900 |
| Michigan | 35 | 20 | 22 | 15 | 38 | 30 | 119 | 130 | 137 | 155 | 10,589,600 |
| Mississippi | 1 | 1 | 1 | 0 | .... | .... | 2 | 2 | 14 | 14 | Gas. Prod. |
| Montana | 9 | 3 | 8 | 3 | .... | .... | 12 | 10 | 48 | 40 | 3,797,000 |
| New Mexico | 22 | 26 | 19 | 19 | .... | .... | 22 | 19 | 96 | 93 | 16,529,050 |
| New York | ... | ... | ... | ... | .... | .... | 3 | 0 | 2 | 1 | 2,880,700 |
| Ohio | 101 | 87 | 73 | 59 | .... | .... | 57 | 51 | 193 | 184 | 4,291,000 |
| Oklahoma | 166 | 161 | 117 | 108 | 220 | 210 | 93 | 87 | 498 | 512 | 176,506,550 |
| Pennsylvania | 20 | 6 | 16 | 5 | .... | .... | 32 | 22 | 82 | 74 | 15,353,850 |
| Texas | 1051 | 837 | 791 | 666 | 1053 | 1284 | 352 | 410 | 907 | 1206 | 380,848,000 |
| West Virginia | 21 | 53 | 18 | 42 | .... | .... | 19 | 19 | 67 | 68 | 4,043,550 |
| Wyoming | 5 | 5 | 3 | 4 | .... | .... | 5 | 5 | 68 | 71 | 12,371,100 |
| Total | 1727 | 1434 | 1296 | 1098 | 1570 | 1796 | 902 | 989 | 2809 | 3095 | 903,850,812 |

# PROGRESS OF MAJOR PIPE LINE WORK

A 162-mile natural gas pipe line, extending from Glenda, Wyoming, to Bridgeport, Nebraska, will be constructe by the North Central Gas Company of Nebraska and Wyoming at a cost approximating $1,250,000, it has been announced. Plans for the purchase of the right-of-way are progressing, and laying of the line is scheduled to start in late summer or early fall, the announcement further states. Contracts for the pipe are said to have been let. Natural gas at present is being brought into that section of Nebraska through leased lines, and it is reported that those lines in the future will be used only to transport crude oil.

●

A pipe line outlet is being provided by the Texas Pipe Line Company for the discovery well in the new Monument area in Lea County, New Mexico. The new pool is considered a major oil strike and a nine-mile 6-in. line is being laid to the pipe line company's booster station in the Eunice field.

●

The second pipe line outlet for the Edmond field of northern Oklahoma has been provided by the Continental Pipe Line Company. It is a nine-mile 4-in. line tying into the Continental's trunk system between Oklahoma City and Ponca City. E. L. McCarthy of Tulsa was the contractor. The new artery is a welded line.

●

The Beggs Pipe Line Company recently completed a new compressor station at Beggs, Oklahoma. The booster units are two 80-hp. Cooper-Bessemer compressors with a capacity of 3,000,000 cu. ft. of gas daily. C. J. Smith, construction engineer of Tulsa, Oklahoma, designed and supervised installation of the station.

●

The Stanolind Pipe Line Company has instituted a reconditioning program on its line between Ranger, Texas, and its Graford station in northeast Palo Pinto County. This 8-in. line is 45 miles in length and transports crude from the Ranger and other Eastland County fields. Tests are being made and those portions of the line found sufficiently corroded to warrant attention are being worked over.

●

A 6-in. natural gas pipe line will be constructed by the Municipal Service Company of Kansas City, Missouri, from the Jackson, Mississippi, field to Canton, Mississippi, a distance of 25 to 30 miles, it is announced. Plans call for a $190,000 PWA appropriation to pay the cost of the line. Approximately 200 connections will be available at Canton. That municipality owns two gas wells in the Jackson field.

●

The Kentucky Natural Gas Company has laid a ten-mile 6-in. extension line to the new Oaktown, Indiana, gas field, discovered recently by the Gardner Petroleum Company of Tulsa, Oklahoma.

●

The Michigan Public Utilities Commission has under consideration a request by the Consumers Power Company to construct and operate additional natural gas pipe lines in central and eastern Michigan counties. At present the Consumers Power Company is operating a 60-mile line extending from the Broomfield Township field in Isabella County to Midland, Saginaw and Bay City, serving those municipalities. If the request is granted a 30-mile extension will be made from that line to the Hinton-Millbrook-Belvidere townships field in Mecosta and Montcalm counties. Production would be taken from the Michigan Exploration Company of Muskegon, the Gordon Oil Company of Mount Pleasant, the Columbia Oil and Gas Company of Kalamazoo, F. Irwin Bryan and Harry T. Martin of Detroit, and Dr. Virgil R. D. Kirkham and James C. Graves of Saginaw. The Consumers Power Company has a contract with these operators for the output of eight completed wells producing more than 50,000,000 cu. ft. of gas daily, as well as all future production. The Consumers Power Company also is seeking permits for extensions in Saginaw, Bay, Tuscola, Isabella, Gratiot, and Clare counties.

●

The Lone Star Gas Company, Dallas, Texas, has laid ten miles of 12-in. line from its Riesel station to Waco, Texas, connecting the Long Lake field in Anderson County with that city. Late last year the Lone Star constructed a 70-mile line from the Long Lake gas area to the Riesel station.

●

The recently-discovered Camp Hill pool in Anderson County, Texas, has been connected by the Gulf Pipe Line Company to its West Texas-Gulf Coast trunk system. Twelve miles of 6-in. pipe were laid from the field to the Elkhart station.

●

The Commissioners Court of Nueces County, Texas, recently granted a franchise to J. K. Coulton for the construction of natural gas pipe lines from the Agua Dulce field to Corpus Christi and other towns within a radius of 30 miles. The franchise is for a period of 25 years.

●

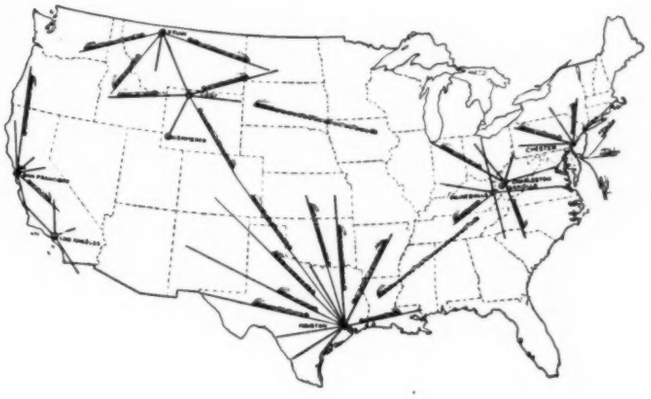
The San Diego (California) Consolidated Gas Company has completed the installation of a 16-in. high-pressure welded steel pipe line over a newly-constructed concrete bridge crossing the San Diego River on the New Pacific Highway in California. Aluminum paint was applied to the pipe and the completed line suspended on heavy steel hangers embedded in the concrete deck of the bridge overhead. Thirty tons of pipe were used.

●

The United States Supreme Court has reversed, on appeal from the State Supreme Court of Kansas, an order of the State Highway Commission of Kansas directing the Panhandle Eastern Pipe Line Company to relocate its transmission lines at its own expense. The order of the highway commission directed the pipe line company to remove its transmission lines upon the adoption of plans for a new highway that will cross the company's right-of-way, without reimbursement to the company of the cost of the changes. The Kansas statute authorizing the commission to require the company to remove the pipe line at its own expense was declared unconstitutional, in that its property would be taken for public use without compensation and, therefore, without due process of law, contrary to the fourteenth amendment of the federal constitution.

# 24 Hour Service

From our strategically located distributing centers to your locations.



The movie illustrations show "Chester" casing being used in the East Texas field.

These "shots" taken in the field furnish authentic testimony to the satisfactory performance of "Chester" Casing.

•

CHESTER *also makes "Wrought" Iron pipe . . . manufactured from genuine old-fashioned hand puddled muck bar made in our own mills from 100% pig iron.*

**SOUTH CHESTER TUBE COMPANY, Chester, Pa.**

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H. A. Morse, 30 Church St., New York, N. Y.

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*District Offices*

J. D. Swartz, 1231 S. Evanston St., Tulsa, Okla.

E. L. Moseley, 2218 Mills St., Houston, Texas.

Burt S. Shafer, Southwest Representative, 4313 Fairfax Ave., Dallas, Texas, or 603 Petroleum Bldg., Fort Worth, Texas.

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Western Supply Company, Tulsa, Oklahoma, and Branches.

International Supply Co., Tulsa, Oklahoma, and Branches.

Dunigan Tool & Supply Co., Breckenridge, Tex., and Branches.

Bridgeport Machine Co., Wichita, Kansas, and Branches.

Louisiana Supply Co., Sulphur and Brimstone, La.

Oil Field Equipment Co., San Antonio, Texas.

Okmulgee Supply Corp., Okmulgee, Okla., and Branches.

Stephen H. McCabe, 508 4th St., San Francisco, California.

Herley Supply Co., 3006 Cherry Avenue, Long Beach, California.

Barde Steel Co., Seattle, Wash., and Portland, Oregon.

Star Drilling Machine Co., 550 Clinton St., Portland, Ore., and Akron, Ohio.

United Pipe & Supply Corp., Charleston, West Virginia, and Branches.

Bovaird & Co., Bradford, Pennsylvania.

Kane Supply Co., Kane, Pa., and Branches.

Prichard Supply Co., Mannington, W. Va., and Branches.

LeValley, McLeod, Kinkaid Co., Elmira and Olean, N. Y.

# CHESTER

## STEEL CASING AND LINE PIPE

# THE MONTH'S ACTIVITIES IN REFINING

## Per Cent Refinery Capacity Operated

**Eastern Division, 78.6 per cent** **Central Division, 66.4 per cent** **Western Division, 59.6 per cent**

THE Sabine Valley Gasoline Company, Inc., with main offices in Shreveport, Louisiana, and headed by H. R. Dickerson, has completed its new plant in Gregg County, East Texas field. The plant is of the compression and rectifying type, operating at high pressures, and has a capacity of 12,000,000 cu. ft. of gas daily, manufacturing 30,000 gal. of natural gasoline per day. Approximately 1000 wells are connected to the plant with provisions for additional wells as needed. Compressor units consist of 11 Cooper-Bessemer twin compressors of 230 hp. each, operating on two-stage compression. In the first stage the gas is compressed from 10 in. vacuum to 50 lb., with the discharge pressure from 250 to 300 pounds. Seventy-five miles of gathering and residue lines have been laid, the former being of 12-in., 14-in., 16-in., and 20-in. pipe. A loading rack has been provided, having a capacity of six cars, to be enlarged later for handling eight cars.

H. H. Beason, engineer, was in charge of construction. D. E. Farris is plant foreman. C. E. Wharton, of the Hanlon Gasoline Corporation of Texas, and P. M. Raigorodsky, of Petroleum Engineering, Inc., were consulting engineers assisting with the construction work.

●

The Heath Refining Company, formed by A. Heath and R. Beasley, has erected a refinery at Camps Switch in the East Texas field. This is a skimming plant with a daily capacity of 2500 bbl. of crude.

●

The largest gasoline plant to be constructed in Oklahoma in over a year is under way in the Fitts field of Pontotoc County, being built jointly by J. E. Crosbie, Inc., and the Warren Petroleum Company. At first the plant will process about 10,000,000 cu. ft. of gas daily, gasoline production being approximately 5000 gal. per day; however, it will be capable of manufacturing as much as 25,000 gal. daily when occasion demands.

The plant will operate as a combination compression and absorption system, and will be connected to 50 wells at the beginning.

●

The Sapulpa, Oklahoma, refinery of the Continental Oil Company has been sold to the Brown-Strauss Corporation of Kansas City, Missouri. The plant will be dismantled and the equipment sold.

The refinery, erected in 1928 and completely overhauled two years ago, represented an initial investment of approximately $2,500,000.

●

The refinery of the Paragon Refining Company at Lueders, Texas, and pipe lines into the adjacent oil field of Shackelford County, have been sold to the Panhandle Refining Company of Wichita Falls, Texas. The Paragon company was owned by the Freeman-Hampton Oil Company of Wichita Falls and J. C. Hester of Lueders. The plant is to be enlarged, the work to start immediately, and the pipe line is being extended to care for the increased requirements.

●

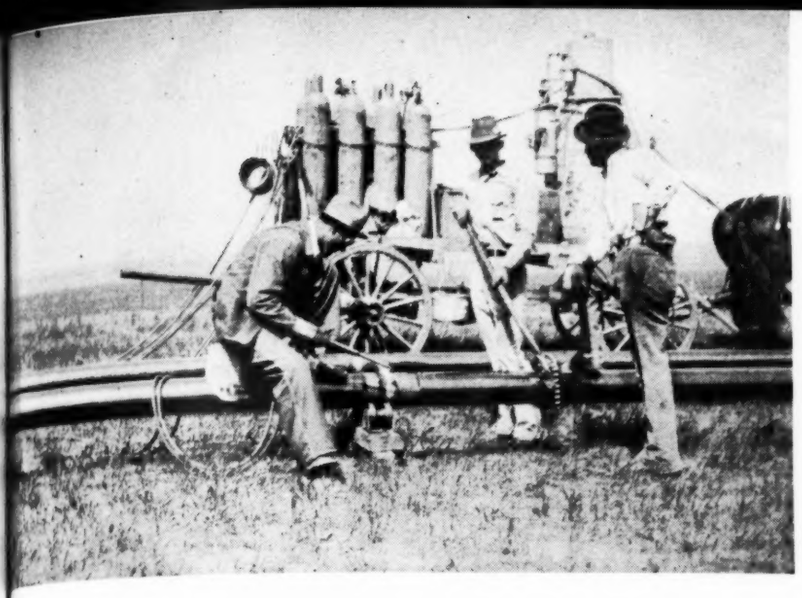
Construction work is under way on the Wilshire Oil Company's new refinery in the Santa Fe Springs field of California, where the company has a 250-acre tank farm. The Ralph M. Parsons Company of Mt. Vernon, Ohio, has the contract for the job. The refinery, to have a crude capacity of 12,500 bbl. a day, is being built around a Dubbs cracking unit of the latest type, which will have a daily charging capacity of approximately 8000 barrels. The Wilshire's contract with Parsons includes working tanks, boilers, fire protection installation, electric power plant, sewer system with oil trap, oil transfer and yard pipe system, water circulation and cooling system, office, warehouse and shop, together with grading and other miscellaneous work.

●

**Crude Runs to Stills, Gasoline and Gas and Fuel Oil Stocks, Week Ending April 27, 1935**

**A. P. I. Figures**
(Figures in Barrels of 42 Gallons Each)

| DISTRICT | Per Cent Potential Capacity Reporting | Daily Avg. Crude Runs to Stills | Per Cent Operated of Total Capacity Reporting | Total Motor Fuel Stocks Thousands of Bbl. | Gas and Oil Fuel Stocks Thousands of Bbl. |
|---|---|---|---|---|---|
| East Coast | 100.0 | 465,000 | 79.9 | 17,253 | 8,971 |
| Appalachian | 93.3 | 100,000 | 71.4 | 2,138 | 727 |
| Ind., Ill., Ky | 94.6 | 357,000 | 84.6 | 9,546 | 4,162 |
| Okla., Kans., Mo. | 83.7 | 262,000 | 67.9 | 5,682 | 4,027 |
| Inland Texas | 47.6 | 87,000 | 52.1 | 1,376 | 1,736 |
| Texas Gulf | 97.7 | 511,000 | 87.1 | 6,543 | 8,939 |
| La. Gulf | 96.4 | 108,000 | 66.7 | 1,310 | 3,104 |
| No. Louisiana-Ark. | 83.7 | 45,000 | 58.4 | 273 | 313 |
| Rocky Mountain | 66.7 | 41,000 | 64.1 | 901 | 770 |
| California | 96.9 | 453,000 | 55.1 | 10,075 | 64,038 |
| TOTALS WEEK: | | | | | |
| April 27, 1935 | 89.8 | 2,429,000 | 71.3 | 55,097 | 96,787 |
| April 20, 1935 | 89.8 | 2,386,000 | 70.0 | 55,865 | 97,246 |



Making a firing line weld by the oxy-acetylene method

By
FRANK
H. LOVE

# Another Major Gasoline Line Completed in the Mid-Continent

DESPITE the interference of severe dust storms and high winds, laying of the 6⅝-in. 254-mile gasoline line of the Cimarron Valley Pipe Line Company, has been completed ahead of schedule. The line extends from Enid, Oklahoma, northward via Hutchinson, Kansas, to Superior, Nebraska, and is the third gasoline line of major proportions to be constructed in the Mid-Continent area. Although no extreme construction difficulties were encountered other than the dust storms, at times these became a real hazard, especially in Western Kansas. As one of the contractors expressed it: "This is the first time in pipe line history that a contractor ever prayed for rain." In sections of the country where the soil was particularly sandy it was no uncommon occurrence for the pipe strung along the right-of-way to become drifted full of dust and sand. The procedure followed in blowing the dust from the pipe was to place a ½-in. nipple on the end of a hose, run this through a block tapered in such a manner that, when inserted into the pipe joint, no air could back up, and apply 200 lb. air pressure. This served effectively to clear the line.

From Enid to Hutchinson, a distance of 110 miles, the B & M Construction of Oklahoma City was the general contractor, with H. C. Price, Inc., of Bartlesville, Oklahoma, the welding contractor. That portion of the line was electric welded. The north end, from Hutchinson to Superior, Nebraska, a distance of 144 miles, was under contract to Truman & Smith Construction Company of Eldorado, Kansas, who did their own welding, using the oxy-acetylene method.

Two construction crews were employed on either end of the line. On the south section one "gang" started at Hutchinson and worked south, the other at Enid and proceeded north. On the northern section similar procedure was followed, one crew working north from Hutchinson, the other south from Superior. The contractors completed their work well within the time limit of 45 working days specified in their contracts. More than 15 days were lost, chiefly because of dust storms, but these, coming under the term of "acts of God," were allowed as credits under provisions of the contract.

Terminals for the loading of tank cars and trucks have been constructed at Hutchinson and Superior. For the time being but one pumping station will be erected, officials of the company have announced, that to be at Enid. This station will be completed about May 20 and the first gasoline will be sent through the line about June 1. The line will be used exclusively, at first, for transportation of Champlin Refining Company gasoline, and initial shipments will be from 3000 to 4000 bbl. daily. It is entirely likely, however, that shipments will be made for other interests at a later date, officials of the company have stated. When the volume of gasoline moved becomes sufficiently large to warrant the step, a second pumping station is to be constructed at Hutchinson.

### South End of Line

The ditching crews on the south end of the line encountered few outstanding difficulties, although it was necessary to cross numerous rivers and in spots there was considerable shale with which to cope, and some blasting had to be done. With each construction crew having two machines in service, an average of

Showing a double-reverse bend, with the pipe on skids above trench prior to lowering in

Making a firing line weld by the shielded arc process

found in the coating, perhaps the greatest cause of holidays was tiny gnats, particularly bad in that section of the country at this season of the year.

Tractors of 30 hp. were employed for lowering the pipe into the ditch. This operation was accomplished in the early morning when the pipe was cool and fully contracted.

Five river crossings were made. The north fork of the Ninnescah River was crossed near Castleton, Kansas, the south fork of the same river north of Norwich, Kansas, the Arkansas River at Hutchinson, the Chikaskia River north of Danville, Kansas, and the Salt Fork of the Arkansas River south of Medford, Oklahoma. A double coating of enamel was applied to the river strings, and 400-lb. river clamps, spaced approximately 20 ft. apart. After the strings were made up and the ends closed with bull plugs they were pulled into position by tractors equipped with winches. Although the rivers at the points of crossing averaged a half mile in width, they were shallow and manual labor was used for ditching.

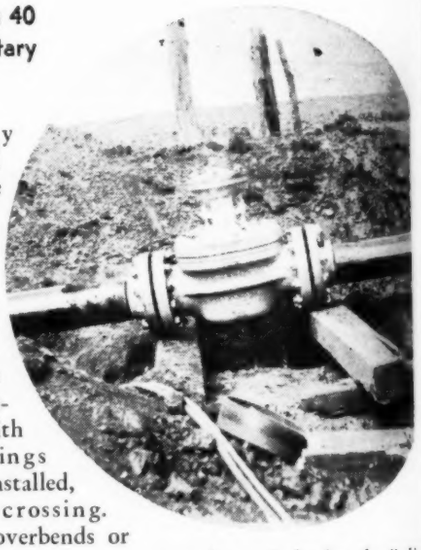
four miles of ditch was dug daily, the trench being 18 in. wide and 30 in. deep. Buckeye and Barber Green ditchers were used.

Pipe used in construction of the line was all Youngstown Sheet & Tube Co. new stock of 6⅝-in. O.D., shipped to convenient stations along the route. No difficulty was encountered in stringing the pipe since, for the most part, the topography of the country is level and highways and improved side-roads are conveniently situated. Eight International trucks equipped with booms and winches were employed for the work, each carrying loads of eighteen 40-ft. lengths of pipe.

The two welding crews on the south end used a total of 14 Lincoln electric welding machines, each employing four machines for roll welds, one for tacking, and two for bell-hole welds for tying-in. The pipe was lined up on dollies by hand. The dust and sand storms presented a serious problem for the welders, it being frequently impossible to weld at all. At other times a special shield had to be used to break the wind and keep out as much of the dust and dirt as possible. The shields were square-shaped and consisted of a frame constructed of 14-gauge metal covered with sheet iron, and made to fit the contour of the pipe. Despite the obstacle presented by the blowing dust and sand some excellent speeds were made. The average number of welds per day per man was 70. The pipe was welded into 200-ft. sections, no backing up rings being used.

The entire line was coated with hot Bitumastic enamel, applied in the field. After being tied-in and placed on skids over the ditch, metal lathes were used to dislodge dirt, rust, etc., from the pipe, following which the priming coat was brushed on. The hot enamel was "ragged on" in the conventional manner. Equipment for this work consisted of four pots of 5-bbl. capacity mounted on wheels, with high-pressure coal oil burners for heating the compound. Inspectors employed mirrors for the detection of holidays on the underside of the pipe, and intermittently a holiday detector was run to make doubly certain that no holidays escaped detection. This holiday detector, previously described in this publication, consists of a metal ring from which extends fine wire fingers. Encircling the pipe, the fine wires touch the surface, and the detector is moved along the pipe by hand. When one of the wires comes in contact with a break or thin spot in the enamel coating, an electric current supplied by a storage battery closes the circuit and the short circuit thus created causes a buzzing sound. While comparatively few faults were

Crane Series 40 cast-steel rotary valve



All highway and railroad crossings were bored with regulation boring equipment and cased with 8-in. casing. The space between the line pipe and the casing was sealed with Dresser couplings and 2-in. vents installed, two to each crossing. Where bends, overbends or sags were required, they were made entirely by the "cold bend" method. Tractors, McCormick-Deering and Caterpillar, equipped with booms and winches were successfully used in this procedure to fit the pipe to the contour of the ditch. One of the accompanying illustrations shows a double reverse bend to make which the welded section was placed in the ditch, the boom lowered to the level of the ground above the trench and one end of the pipe hooked onto with carrying tongs and the pipe bent the desired angle.

### North End of Line

The work on the 144 miles comprising the north end of the line, from Hutchinson, Kansas, to Superior, Nebraska, perhaps was delayed more from the effects of the dust storms, being on the fringe of the territory where most of the storms have had their recent origin.

The topography on this portion of the line was mostly of a rolling nature, but rough in places. When found too rolling or too rough to permit stringing the pipe along the right-of-

way in the usual manner, it was "spotted" in favorable locations, welded, and carried in by tractors. Approximately 60 miles of the line was through country that made it necessary to follow this procedure at least intermittently.

The three ditchers averaged a mile of trench per day. In general the soil was soft, although some rocky formation was encountered, particularly north of Brooksville, Kansas, where blasting was resorted to.

The pipe was lined up on dollies manually for the making of roll welds, the Linde speed rod No. 24 being used, and some excellent speeds were made by the firing line welders. The two firing line gangs were each composed of four welders and one relief man, with one tack welder working in conjunction with each line-up gang.

The hot enamel coating was applied to the line at approximately 400 to 425 deg. fahrenheit. One "hot spot," approximately two miles in length, was encountered near Jamestown, Kansas, where the line crosses a salt marsh. To cope with this condition the line was double coated.

Periodically the line was tested for tightness by the application of 100 lb. air pressure, a 48-hour test being given.

Five river crossings also were made on the north end of the line. The Solomon River was crossed at Glasco, Kansas, and, although only 200 ft. wide at the point of crossing, presented greater difficulties than any of the others, since it is a treacherous stream with high banks. One and one-half miles east of Warwick, Kansas, a 571-ft. crossing was made across the Republican River. The Smoky Hill River was crossed at West Marquette, Kansas, a 200-ft. crossing, the Little Arkansas River at North Medora, Kansas, a 150-ft. crossing, and the Saline River at Tescott, Kansas, a 200-ft. crossing. The rocky condition of the bed of the Little Arkansas River necesitated the blasting of the trench. The string of pipe across the Republican River was arched upstream for a distance of 95 ft., and the pipe buried by hand labor. The river clamps, each weighing 600 pounds, were spaced 20 ft. apart. Extra precaution was taken that there should be no faults in the river strings, the pipe being tested before and after it was put in the river.

Orbit valve manufactured by Oil Well Improvements Co.

### Gate Valves

Gate valves were installed approximately every five miles. Half the valves were Crane Series 40 cast-steel rotary valves, manufactured by Crane Co., Chicago; and half the Orbit valve, manufactured by the Oil Well Improvements Co., Tulsa, Oklahoma.

The Orbit valve is of a new type designed to eliminate friction incident to opening and closing. Test installations have been made on other gasoline lines but, being a new product, this marks their initial use in appreciable quantities. The valve employs the principle of the lever rather than the wedge, the former being frictionless. The lever is utilized to open the valve as well as close it, and acts by first lifting the valve off the seat and then moving it to one side of the opening. The valve consists of a rotary core mounted on a journal within the valve body. In operation the stem is turned and carries the valve core with it until the valve face is positioned directly opposite the seat, the core then ceasing to turn, and further movement of the valve stem forces the valve face out against the seat. To open the valve, the stem is turned in a left-hand direction, withdrawing the valve face from its seat and then rotating the core until the opening through the core lines up with the inlet and outlet openings of the valve body, providing a smooth passage and covering and protecting seats from injury.

### Pumping Station

The pumping station at Enid is situated near the Champlin Refining Company's plant, making it possible to pump gasoline directly from the refinery's storage tanks.

The station building is of brick construction with a brick firewall between the motor and pump rooms. Because of the inflammable nature of the fluid pumped every precaution has been taken to eliminate fire hazards.

One of the pumping units consists of a General Electric 150-hp., 3-phase, 60-cycle, 2200-volt, vaporproof motor, capable of 3550 r.p.m., direct-connected to a Goulds 8-stage centrifugal pump. The pump has a capacity of 138 gal. per min., a 2350-ft. head, and is capable of 3550 r.p.m. It is so designed that by changing impellers a capacity of 253 gal. per min. can be obtained. The sleeves are fashioned of hardened stainless steel, and, due to the cutting nature of the fluid pumped, a special gland packing is used.

The other pumping unit consists of a 60-hp., 3-phase, 60-cycle 440-volt, 1200 r.p.m., squirrel cage ball bearing induction motor driving a Fairbanks-Morse 4½x10 duplex self-oiling power pump specially equipped for gasoline pumping service. The capacity of the pump is 4000 bbl. per day, and by changing the fluid end the capacity can be increased to 7000 to 8000 bbl. daily. Initially, the station will be operated at 750 lb. line pressure.

### Terminals

The terminals at Hutchinson and Superior, for the loading of tank cars and distribution trucks, are each equipped with two 37,000-bbl. tanks made by the Pittsburgh-Des Moines Steel Co., and three 10,000-bbl. tanks having Wiggins floating roofs. A loading rack for trucks and one for tank cars have been provided, the latter capable of loading ten cars simultaneously. Small-sized loading pumps also are a part of the equipment. For the present all blending will be done at the refinery at Enid; later, however, it is probable that blending equipment will be installed at the terminals.

The entire line was coated with hot enamel

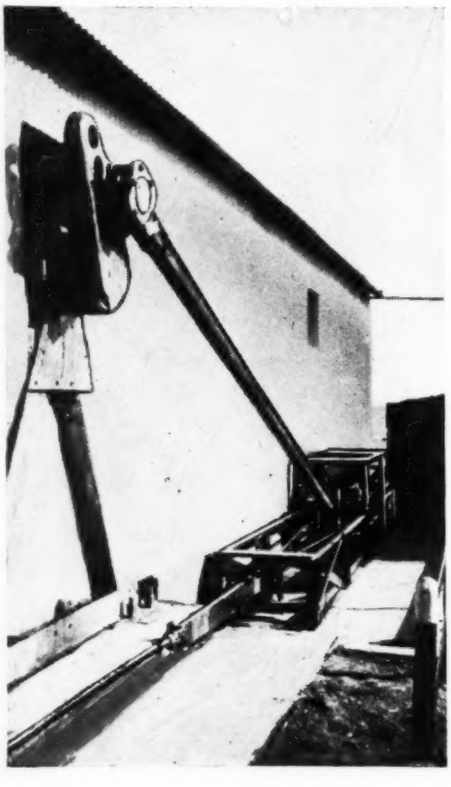
Pendulum type stroke-post on a well in the Ritz-Canton Pool, McPherson County, Kansas. It is operated from a chain-driven enclosed steel front. Note the pipe connections from the stroke-post to the knock-off post

By VAN D. BENNETT
Production Engineer, The Derby Oil Company

Part I

# Backside Crank Pumping in Kansas Fields

THE development during the past two years of the application of backside cranks for pumping wells in the Kansas section of the Mid-Continent area has been greatly accelerated during the past six months. In analyzing the factors that have given impetus to this method of production, we find three of great importance: first, the value of salvable equipment; second, the reduction of operating and maintenance costs; and third, where new wells are involved, the reduction of initial investment. These factors on back-crank application may be divided into two main divisions: one concerning the installation of back-crank equipment on new wells, the other dealing with the substitution of back-crank equipment in place of the conventional standard rig pumping equipment formerly in use on the wells. By far the greater percentage of the installations made in this territory fall in the latter category.

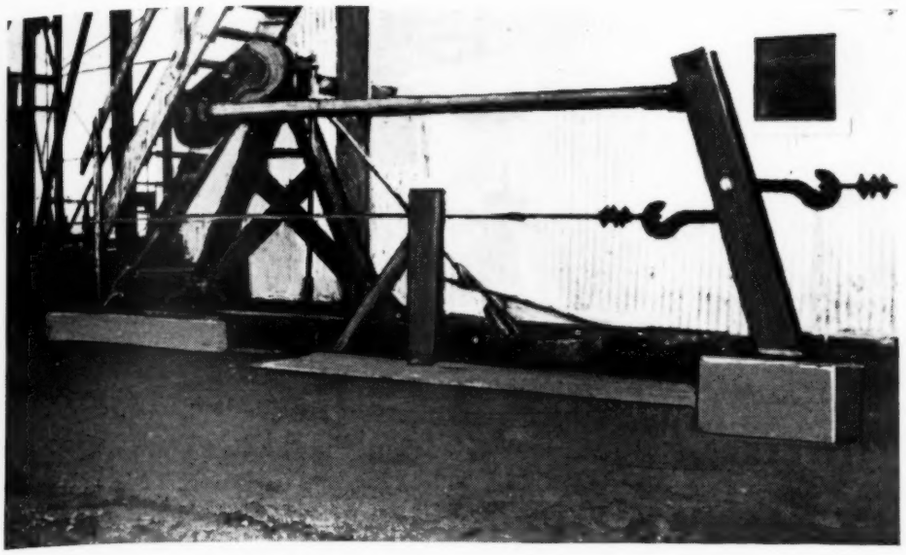


### Reduction of Initial Investment

The original application of pumping relatively deep wells from back-cranks appears to have had its inception in the East Texas field, where the small volume of fluid produced per well per day made an ideal set-up for its use. The tremendous reduction of initial investment required in the East Texas field for this type of installation can be readily understood. Operators in other areas have been more or less reluctant to install back-crank units on new wells. There are no pools in Kansas that compare with the East Texas field in regard to the method of determining allowables. On each new well completed a potential test on the pump must be taken, ranging from one to four days in duration, and obviously with the well producing the maximum possible amount of fluid. The inconsistency of the productive capacity of one well in relation to an offset well in many fields in this area makes the pre-determination of the size of the well and the subsequent proper surface equipment installation a rather hazardous guess. For this reason new wells are generally equipped with the standard single well-pumping equipment, and after being on production for some time, if it is seen that the installation of back-crank equipment is feasible, the change is then made. With one or two exceptions, therefore, the reduction of initial investment, which was the motivating factor in the installation of this type of equipment in East Texas, has not entered the picture in this area.

Deep wells recently completed in Kansas that have been equipped with back-crank pumping facilities were drilled-in with standard portable drilling-in units and the potential pumping tests taken with the drilling-in unit still in place. With the information on fluid capacity obtained from the poten-

Combination horizontal roller stroke-post and slide bar knock-off posts. Wrist pin is of spherical type and has a self-aligning bearing. Two 3400-ft. wells producing from the Wilcox sand in McPherson County, Kansas, are operated from this crank.



Stroke-post with extra steel jack-post and extension shaft on well in Burrton field, Harvey County, Kansas. Two jack wells 3200 ft. deep pumping at speed of 28 strokes per minute with about a 36-in. stroke are operated from this stroke-post. About 500 bbl. of fluid per well per day is lifted.

tial test, and knowing the characteristics of the oil decline and the probable water encroachment of that particular area, the operator was able intelligently to install a back-crank unit with a margin of safety that would protect him in taking future potentials. Obviously, any back-crank installation put on new wells that will successfully take a potential test, will very easily handle from ten to 50 per cent of this potential capacity in producing the daily allowable.

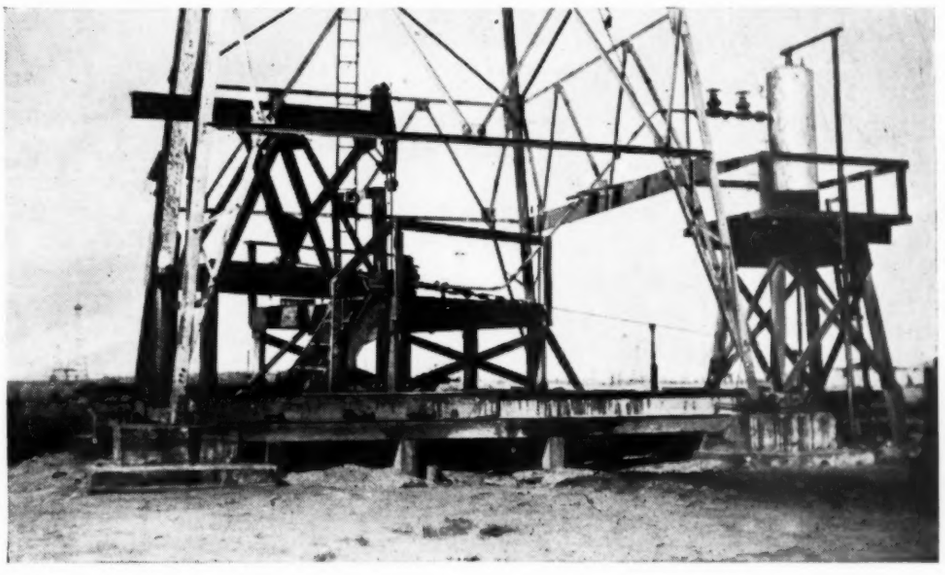
On a 3-well hook-up where the wells are one or two locations apart, the investment will be reduced some $6,000 to $10,000 by installing back-crank equipment instead of three standard rigs of 20,000-lb. capacity. Unfortunately, the uncertainty of potential oil capacity and water encroachment prohibit the general use of back-crank equipment on new deep wells in Kansas flush production areas.

### Value of Salvable Equipment

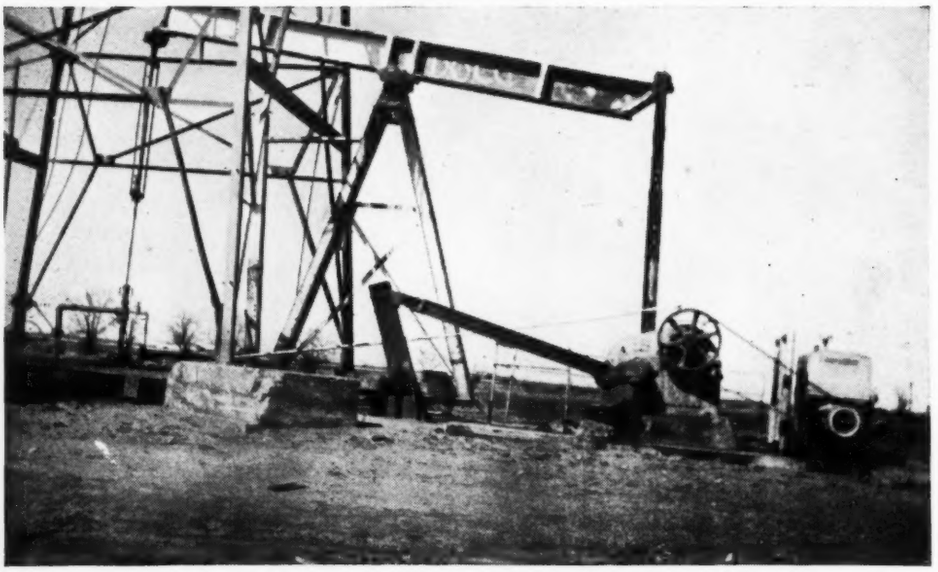
The release of standard well-pumping equipment as the result of installing back-cranks has been the most important factor challenging the operators to adopt back-crank equipment. The value of the equipment that may be salvaged from a conventional standard pumping rig in Kansas by employing backside cranks is from $3000 to $6000 per well. When the average cost of making the substitution is between $800 and $1100 per well the economics of the change is easily understood. The opening of new areas in Western Kansas, and of the Burrton pool, where heavy pumping loads will eventally have to be handled, has created a heavy demand for conventional steel-front pumping rigs. The fact that hundreds of these rigs are now in use in the Ritz-Canton, Voshell, Hollow, and other pools where the fluid loads have been reduced to a very low figure, makes it very desirable to release this equipment and to substitute back-crank installations that handle these light fluid loads with ease. The use of central powers is not generally applicable in these fields, because of the inconsistent well-spacing and the diversity of acreage ownership. The actual values of the equipment salvaged on an average well in this area may be set up as follows: (Valuation estimated at approximately 75 per cent of initial cost).

| | |
|---|---|
| Engine | $1200.00 |
| Clutch | 500.00 |
| Engine house and belt hall | 400.00 |
| Steel front, beam, and pitman | 500.00 |
| Bullwheel and bandwheel | 700.00 |
| Belts | 250.00 |
| Water, tank, pump, etc. | 150.00 |
| Counterbalance | 250.00 |
| Miscellaneous | 150.00 |
| Total average salvable value per well | $4100.00 |

This value will vary from 50 per cent higher to 25 per cent lower than the figure here given, depending upon the type and make of the equipment salvaged.



Pump jack powered by a back-side crank on a lease in the Ritz-Decker field, Kansas. This is a combination dry gas and oil well; the height of the Braden head necessitated the unusual elevation of the pump jack.



One of the most unique back crank arrangements in use in the Mid-Continent area. Caterpillar multi-cylinder engine transmitting power through an O.C.S. chain reduction unit, driving key well from beam and operating a jack well from a rocker type stroke-post arrangement. This installation is in the Ritz-Canton field, Kansas.

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### Reduction of Operating and Maintenance Costs

Equipment carefully chosen, properly installed, and efficiently operated will materially reduce many operating items of expense and thereby lower the lifting cost per bbl. of oil. The most important economies resulting are: (1) reduction in the cost of gas or electricity; (2) reduction in maintenance costs for engine, clutches, belts, and surface equipment in general; (3) reduction of rod, tubing, and paraffin trouble.

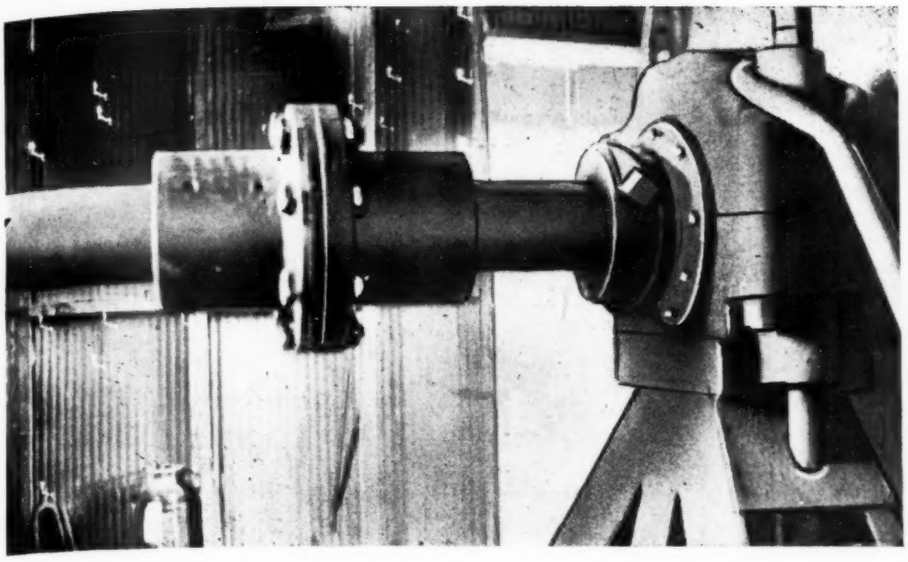
Assume a lease having six wells equipped with standard pumping rig equipment: the cost of gas per 40-hp. engine per month, where it is necessary to purchase gas, will average $30. By eliminating four gas engines, the cost of gas will be reduced from $180 per month to $60 per month. If electricity is used the reduction may be even greater. Compared with six standard pumping rigs, each equipped with a gas engine, the overall maintenance cost on two engines, four jacks, and the auxiliary surface equipment, will be 30 to 50 per cent less. Assuming an average cost per well for labor and material maintenance of the standard rig of $20 per well per month, the actual reduction on a six-well lease could be estimated at $48 per month. The reduction of operating and maintenance costs on subsurface equipment because of slow-speed 24-hour operation is also quite important and will be discussed later.

Assuming a cost of $2160 per year for gas, $1440 per year for cost of operation and maintenance, plus an additional $1000 per year for the relatively inflexible operating costs, the original installation costs a total of $4600 a year. A backside crank installation costs $720 per year for gas, $864 for operating and maintenance, plus the $1000 inflexible operating costs, or a total of $2584 per year. The total reduction in operating costs for the assumed six-well lease for a year will therefore approximate $2016.

●

With an average daily allowable of 20 bbl. per well or 120 bbl. a day for the lease, the total production for a year from this lease would be 43,700 barrels. Based on the use of the individual standard rigs the lifting cost would be 10.5 cents per barrel. By using backside cranks the lifting cost would be 5.8 cents a bbl., a reduction of 4.7 cents per barrel. Since the productive life of these wells will probably extend from four to six years, it is seen that the installation of backside crank pumping equipment on the above type of lease is highly desirable from the standpoint of economical operation.

Pump jack on back crank installation. Note the straight lift, the long stroke, and the headache post. The latter is equipped with an oak filler to take the shock in case of rod-line breakage.



**Special flange coupling used in attaching extension shaft to bandwheel shaft. Part of the extra steel jack-post can also be seen.**

### Capacity of Installations

Manufacturers' recommendations on backside crank equipment are usually based on the capacity of each unit making up the installation. In considering the flexibility of a complete installation, it is found in practice that the manufacturer's unit capacity recommendations are likely to be slightly high. On one installation in Russell County, Kansas, a well 3000 ft. deep, with a 2¾-in. common barrel and a pull-rod line approximately 60 ft. long and pumped from a backside crank unit, produced 1200 bbl. total fluid during the 24-hour potential pumping test; but performances of this kind should not be used as a criterion in estimating the capacity of a jack well on a backside crank installation. Each operator in this area seems to have a rather definite idea of the amount of total fluid that he would attempt to lift with backside crank equipment. This ranges from 100 to 700 bbl., the majority nominating to keep within the range of 150 bbl. of total fluid per day per jack well. In attempting to lift excessive volumes of fluid in these jack wells, the operator sacrifices many of the desirable features of maintenance and operation characteristics that normally result in a reduction of the lifting cost.

### Slow Speed Pumping and Small Diameter Pumps

Most of the engineers with the leading oil companies favor continuous 24-hour operation, relatively long strokes, and a minimum number of strokes per minute. On wells of small production, continuous operation, and a minimum number of strokes per minute two important considerations in connection with backside crank installations are: proper transmission ratio, in order to permit slow speed pumping; and the use of small diameter pumps. In many cases the latter is the deciding issue in obtaining low operating costs with this type of installation.

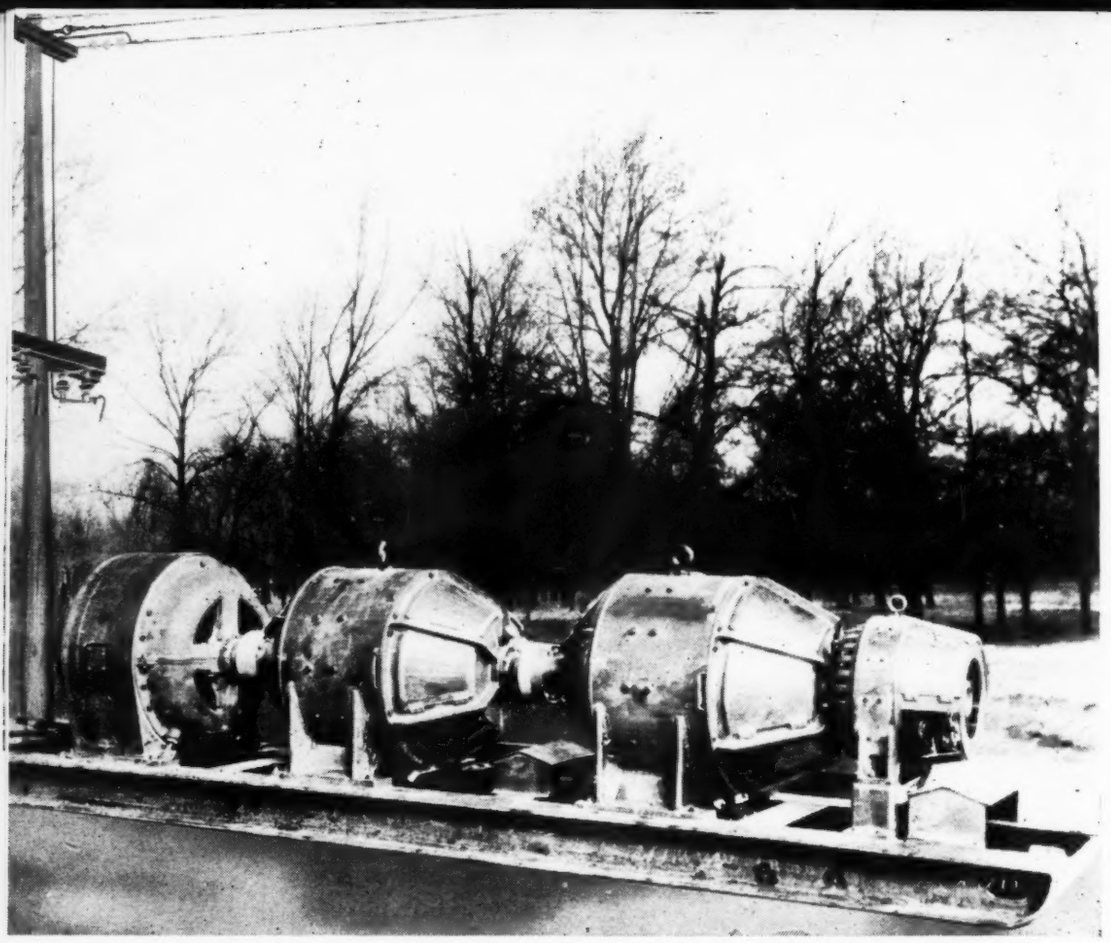
In practically all cases, the pulley ratios initially installed with gas-engine-driven units of the ordinary type are not adapted for backside crank pumping units; first, because the slow speed desired at the jack wells is impossible to attain, and second, because of the detrimental strains imposed on the engine, belts, surface, and subsurface equipment when the engine is operated at a speed greatly below its proper continuous minimum operating speed. The correct ratios for slow-pumping speeds has been discussed in a former article.[1]

To obtain the correct transmission ratio for backside crank units a very simple change of pulley diameter is usually sufficient. Belt reduction ratios can be increased either by enlarging the diameter of the driven pulleys or decreasing the diameter of the driver pulleys. The latter is usually done, since it is the less expensive. Reduction of the pulley size undoubtedly decreases the life of the belt, but within a reasonable range the accompanying reduction of belt speed offsets this adverse factor. The use of 12-in. countershaft pulleys and 10-in. motor pulleys has not resulted in excessive belt wear in deep wells in this area. An installation in the Voshell pool pumping continuously at an average speed of ten strokes per minute has an overall ratio of 18 to 1; thereby allowing the installation to run as slow as eight or nine strokes per minute if necessary, and yet keep the engine operating at a reasonably fast speed. In taking a potential with this installation at a rate of 20 strokes per minute, the speed of 360 r.p.m. of the engine is not excessive.

The use of pumps of small diameter having from 1-in. to 1½-in. effective plunger diameter has allowed the operator to pump continuously (24 hours) without "pounding," and is a factor of prime importance in reducing the polished rod load—and subsequently the stress imposed upon the stroke-post at the key well. In many cases it has been found that the substitution of these small diameter pumps has increased the pump efficiency from 20 per cent (formerly obtained with the large diameter pumps) to 80 per cent; and in some cases the potential capacity of the wells to produce has been increased by keeping the fluid pumped down to a critical fluid level during 24-hour operation. Producing wells of small capacity with large diameter pumps, pumping them off twice or more daily and then shutting them down, obviously restricts flow into the hole during the time at which the well is heading up. Continuous operation, made possible by the use of these small diameter pumps, also greatly reduces paraffin trouble by keeping the tubing constantly filled with fluid.

(*Editor's Note*: Part II, the concluding half of this article, will appear in the June 15th issue).

[1] "Power Transmission Ratios on Pumping Wells." (*The Petroleum Engineer*, February, 1933.)



Motor generator set used to power the rig. Power is brought to the pole at 2300 volts and is then transmitted through an oil switch, not shown in picture, to 400-hp. motor at left. The main generators are rated at 240 kw. and 150 kw., respectively.

By

W. C. LANE

# Direct-Current Rig Operated Used to Drill Binger Wildcat

AN offset to Denver Producing and Refining Company's well Adah Noc No. 1 is of unusual interest in that it is being drilled with a direct-current electric rig. Adah Noc No. 1 is about 4½ miles east of Binger, Caddo County, Oklahoma, and was drilled with a steam rotary rig to a total depth of 11,230 feet. It is now on gas-lift and is reported conservatively as good for 50 bbl. of high gravity oil per day. The offset well, the same company's Sah Cam No. 1, is just south and west of the discovery well. Much is yet to be learned about the formations to be penetrated and great care will be exercised in procuring geological data. It is quite probable that the new test may approach if not surpass the existing world depth record.

When it was time to make plans for drilling this test the officials of the company made a careful study of the relative advantages and disadvantages of the different methods of applying energy to rotary drilling and decided to use electricity for the work. Their choice was based on the relative economy, reliability, flexibility, and safety of the possible methods, and on the outlay for machinery each method would incur. Probably the factors that did much to shape their decision were the limited amount of fuel gas available, scarcity of good water, condition of roads leading to the site, proximity of an electric power line, and the future plans of the company.

The well is within reach of a 13,200-volt power line and one would naturally think that an a-c. drive would be used on the rig. Another reason for this conclusion is that the company has owned a-c. rigs for several years and is well pleased with their operation. However, the capacity of the power line is somewhat limited. Unfortunately a-c. hoisting motors have an objectionable characteristic that one must always keep in mind. That characteristic is that they draw a current from the line that amounts to several times their full-load rating while being used to start a heavy load or when used to reverse one quickly. Unless the capacity of a line is large, the voltage regulation will be very bad during pulling operations and the motors will appear to be deficient in power; also, the inhabitants of the small towns served from such a line will receive unsatisfactory service as a result of the disturbances created.

It is now becoming common knowledge among the members of the drilling fraternity that d-c. motors when operated from a variable voltage or Ward Leonard system possess characteristics that make them especially adaptable to rotary drilling. They may be started, accelerated, stopped, and reversed by controlling the magnitude and direction of the current in the generator fields. This current amounts to only a few amperes so that the control rheostats are small and the heating loss in them is negligible. There are neither reversing contactors nor grids of any kind in the mains leading to the motors. This system of control enables one to apply practically all the energy of the driving generator at a motor speed at which it can be utilized. A motor can be made to exert its maximum torque—that is, pull—at rest or while in motion and it will act as a brake if a load overruns it and drives it above its no-load speed. (Readers who wish to review the elementary theory of the variable voltage or Ward Leonard

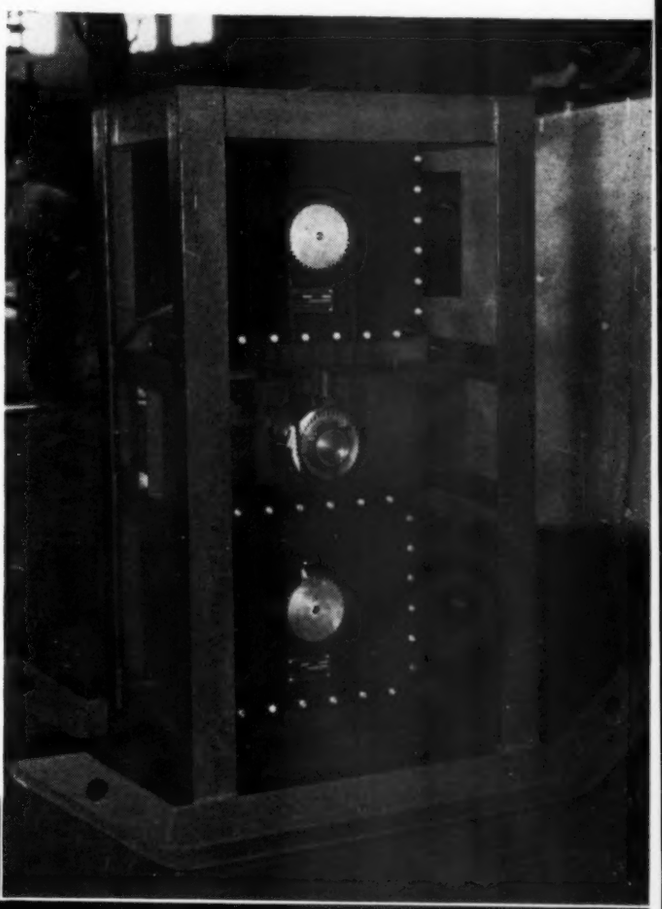
system are referred to the article beginning on p. 49, The Petroleum Engineer, June, 1933.)

After considering the matter from its different angles it was decided to use a d-c. rig. The convenient power line and an attractive rate probably were largely instrumental in causing the company to install a squirrel cage motor rather than internal combustion engines for driving the d-c. generators. The reason this motor does not cause objectionable voltage disturbances on the line is that it is started with a compensator and after it is once in motion it will be run continuously. Automatic characteristics inherent in the d-c. generators prevent the starting and reversing power shocks originating in the d-c. hoisting motor from being transmitted through the a-c. motor to the line. Doubtless during hoisting operations the a-c. motor will be required to carry large overload for short periods of time but these will not create marked voltage disturbances such as are incident to operating a hoisting motor directly from the line.

The first thing visitors approaching the rig will observe will be that a 170-ft. derrick has been provided to simplify the problem of handling long strings of pipe. In looking over the layout in general one receives the impression that much thought has been given not only to making provisions for performing the regular operations involved but also for taking care of any emergencies that may arise on a 12,000-ft test. Concrete of a good quality has been used freely in providing foundations and an ample cellar, and equipment has been sheltered from rain and sun. All electrical equipment in use was manufactured by the Allis-Chalmers Mfg. Company of Milwaukee, Wisconsin. With one or two exceptions the mechanical equipment is of standard type such as is in common use on heavy drilling work everywhere.

# From High Line

**Bottom of Page—Drawworks motor and unitary type drawworks with Hydromatic brake. Blower for cooling motor can be seen at the left in front of motor, and generator field rheostats for controlling both drawworks and pump motors at the right.**
**Directly Below—With the exception of a small drum controller for setting up the connections for the main generators, all the control equipment on the well floor are the two explosion-proof generator rheostats shown in this assembly.**



**275-hp. motor with drive arranged to operate one or both slush pumps. Cooling tower for Hydromatic brake shown on the left.**

Naturally the heart of the rig is the power plant and here anyone interested in machinery will be much impressed with the compactness of the motor-generator set. After one has been accustomed to seeing the formidable array of machinery on the ordinary deep-drilling rig it seems incredible that so small a space can house a unit of sufficient capacity to put down a deep test. The unit includes a 400-hp., 2200-volt, 1200-r.p.m., 3-phase, 60-cycle, squirrel cage motor coupled to a load consisting of two main generators, a 240-kw. 350-volt, a 150-kw. 350-volt, and a 25-kw. 125-volt exciter. The motor and the three generators are mounted on a single set of steel skids, the combined weight of the unit being about 20,000 lb.—almost as much as that of a 100-hp. oil country boiler.

Electrical energy at 13,200 volts is taken from the power line and stepped down to 2200 volts by a bank of transformers. It is then passed through an oil switch and used to drive the 400-hp. motor. In drilling, the 240-kw. generator is used to drive the slush pump and the 150-kw. generator, the drawworks and rotary. At no time is it the intention to operate the drilling and the pumping units from a single generator even though the load is within the capacity of one generator. It may appear that there is an excess of generator capacity for both of these operations, but this is a good fault by reason of possible fishing work. Provisions have been made whereby the larger generator can be used to drive the drawworks and rotary, and the smaller generator the pump. This will give ample power for both fishing and pumping operations. The capacity of the a-c. motor appears to be ample for carrying the possible overloads; for such a type will take at least a 100 per cent overload without hesitating materially, since by nature a squirrel cage motor tends to run at a constant speed and has a large overload capacity.

The switching and control equipment is housed in a metal cabinet mounted on steel skids for convenience in handling. Energy from this panel is transmitted to the drilling and pump motors over cables, each of which has a combined area of 1,000,000 circular mils. This may sound like a very large quantity but the cables are not out of proportion; if one were to measure one with a foot-rule after all the copper in one of the duplex cables had been changed into one solid wire, its diameter would be found to be only one inch.

The drilling and hoisting motor and the pump motor are identical. They are rated at 275 hp., 350 volts, 1000 r.p.m. when rated for a 40-deg. temperature rise for continuous operation, and at 400 hp. at a 50-deg. rise for one hour's operation. They are in reality separately-excited compound motors but the series field is not connected in the circuit when a motor is used on the drawworks. The reason for operating them on pumping duty in this way is that a compound motor slows down automatically when subjected to an overload. The manufacturers believe that this action will have the effect of protecting the pumps from excessive pressures. The motors are totally enclosed so that the crew and the rig are protected from injury by explosion or fire due to gas or oil being ignited by a spark from the commutator. A motor-driven blower is mounted on the base of each motor in order that each may be supplied with ample cooling air. This air may be procured at some distance from the rig when gas is present. Obviously, the quantity of air supplied to a motor is independent of its speed so that a motor may be used to hold a load for a reasonable length of time without endangering it.

Two 7¾x18 pumps insure an ample supply of mud for any pressures likely to be encountered. Provisions have been made for driving either or both pumps from one motor. This is made possible by applying a special Lucey pump jackshaft. The pumps are set side by side with their pinion shafts in the same straight line. A jackshaft on the center of which is mounted the V-belt-driven sheave is set between the pumps in such a position that the axis of the shaft coincides with a

line passing through the axes of the pinion shafts. Each end of the jackshaft is coupled to a pinion shaft by a Diamond three-piece coupling.

Power from the drilling and hoisting motor is transmitted to the drawworks through the medium of a 3.29 to 1 herringbone reduction gear such as is in common use on many a-c. electrically-driven rotary rigs. The drawworks is the first of a new type known as a B 3700 to be put in service by the Lucey Products Corporation. It is of the unit type, has a 9-in. drum shaft and a 26-in. drum 42 in. wide. It provides ample spooling capacity for the 3500-ft. line necessary to handle the record strings of pipe that are to be used on this test. Provisions have been made for six drum speeds, three rotary speeds, and two cat-head speeds. It appears that this drawworks in conjunction with the 20 positions of the generator rheostat will give a range of rope speeds thus far unexcelled. Ample water-cooled brakes and the Hydromatic brake, assisted by the braking action of the motor, will enable the heaviest loads to be handled with ease and safety.

As was already stated, while drilling the 150-kw. generator is used to operate the drawworks and the 240-kw. generator the pump. The switching arrangement is such that the generators may be interchanged if necessary. In hoisting, either or both generators may be used to drive the motor. When both generators are used they are operated in parallel. One may think of parallel and series operation of generators as being analogous to driving two horses side by side and hitching them in tandem.

In order to make a trip with the drill pipe, such as in changing bits, with a minimum expenditure of time, it is necessary to control the hoisting speed so that maximum hp. is used on each hoisting operation. A high hp. must be expended in order that work may be done rapidly. The six-speed drawworks and the d-c. control used on this rig enables the driller to keep the motor loaded under all conditions while making a trip. While going up with the unloaded elevator the motor may be made to rotate above its rated speed, since the voltage of a lightly loaded generator will be greater than that at which it is rated at full load.

In describing the main generators it should have been said that they are self-excited and separately excited and have a series field winding connected differentially. By the latter term it is meant that the series field is so connected that it tends to reduce the voltage as the load on the generator is increased. The result of this action is that it limits the current it is possible to take from the line to a certain amount. In this case the limit is 150 per cent of the capacity of the 400-hp. motor, or to 600 horsepower. Four hundred hp. applied continuously or 600 hp. applied intermittently by means of a system of control such that one can actually use all the power developed, insures an adequate supply of power for all operations.

Drilling was resumed below the conductor pipe April 7 and work is now progressing at a normal rate. Although the test is being watched by many operators interested primarily in what is underground, it is likely that those interested in drilling equipment are going to scrutinize the operating record of the machinery involved with unusual care. As one onlooker expressed it, "I don't doubt the claims made for d-c. machinery but really I can't see how a motor can behave the way they say it does. It seems preposterous to think that a motor can be made to stand still like a steam engine and hold a load; that it can be reversed by reversing the field current of the generator over there in the powerhouse without opening up the circuit leading to it,—but then, I am willing to be shown."

# Square Feet in a Cylinder

## By

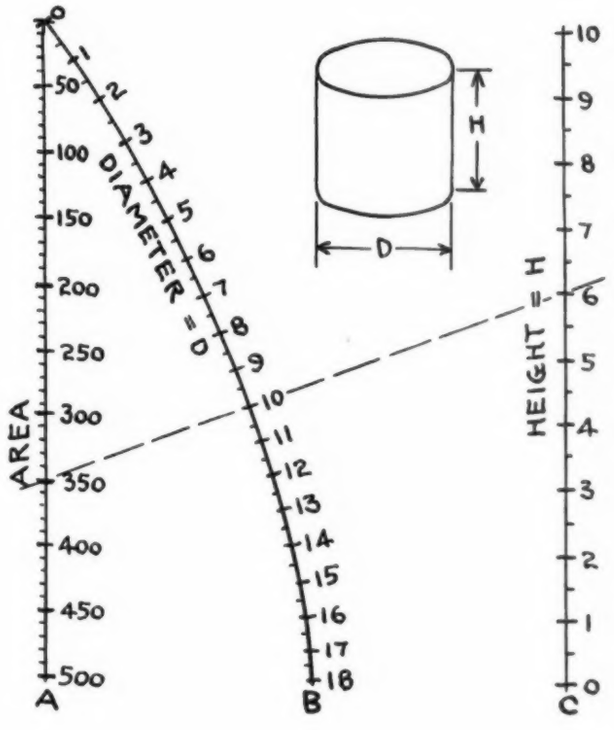
## W. F. SCHAPHORST

WHEN it becomes necessary to build, paint or insulate cylindrically-shaped objects and tanks, it is convenient to know the area in advance in order to buy the materials. Here is a chart that instantly gives the total area of any cylinder of any height up to 10 ft. and any diameter up to 18 ft. The chart automatically adds the two flat ends and the cylindrical surface without any "long hand" figuring whatever.

For example, if the diameter is 10 ft. and the height 6 ft., how many square feet of material are there?

The dotted line drawn across the chart shows how easily it is done. The line passes through the 10, in the curved column B, and through the 6, column C. The intersection with column A shows that the area is 350 sq. ft.

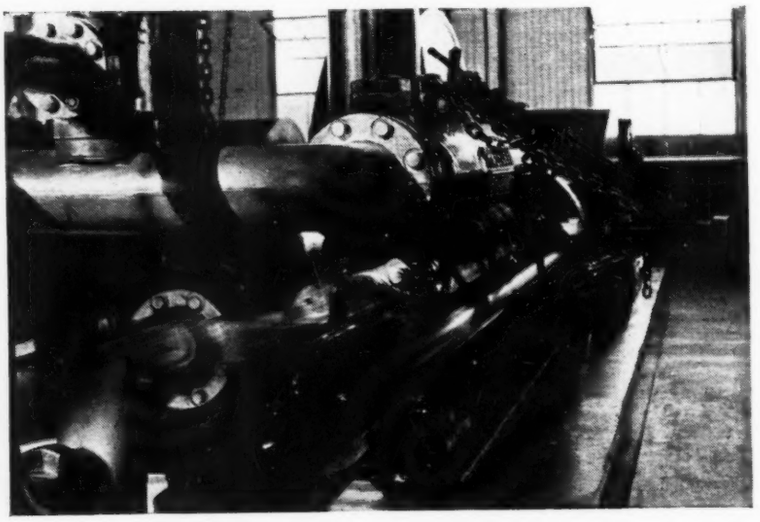
Of course any unit of measurement may be used. Thus, if the diameter and height are in inches, the area will be in square inches. If the diameter and height are in yards, the area will be in square yards, and so on.



# An Emergency Pump Repair

By ELTON STERRETT

THE cast-steel side wall between the working barrel and the valve port chamber on one end of a duplex pump handling crude oil under pressures up to 900 lb. per sq. in. failed in an unusual way. The casting was observed to move outwardly with each pressure stroke on its end, contracting again in a regular "breathing" action as the suction stroke began.



Heavy chains and threaded brace rods strengthen fractured pump casting and permit uninterrupted operation pending receipt of replacement part

With a scale and fixed datum point, this lateral motion of the supposedly rigid casting was found to exceed 0.375 of an inch. When the working pressure was reduced to below 400 lb., this motion practically disappeared, thus indicating considerable wall strength remaining. It was decided to put an emergency "tourniquet" on the bad place, and endeavor to continue the pump in service until a replacement casting from the factory could be obtained.

On a short piece of extra heavy 4-in. pipe for a base, two 1¼-in. threaded rods were welded, projecting vertically from one side. The pipe was then fitted to the pump over the damaged spot, as shown in the illustration. Across the outer ends of both rods a crosspiece of heavy steel was held by nuts on the rods. Chains were then passed around the pump casting, over the crosspiece, and brought around to be hooked with heavy boomers that, when tightened, served to remove most of the slack in the chains. The nuts were then screwed out as tightly as possible, the tautness of each chain being determined by striking a light blow. When the chains were tuned alike—braces being first set to insure side-rod operating clearance—the pump was again put on the line, and working pressure successfully maintained for a period of one month and four days before the shutdown was made to allow of replacement of the damaged casting.

From the operation of the pump and its curious behavior under pressure, it was decided that the side wall had cracked through from within into a fault, or what founders term a "casting shut," and that this pocket was acting more or less like a bellows under pressure. The fact that the pump continued to put out full duty, that there was no hissing sound observable under suction, and that there was pulsation instead of steady distension of the wall was all taken as evidence that the opening did not extend into the valve port space, but received oil from and discharged oil back into the working chamber.

Examination of the casting after removal from the pump showed a crack beginning some five in. from the end wall of the working chamber and extending horizontally for a like distance. The crack itself was so fine as to be almost indistinguishable with the unaided eye, but its presence and extent were indicated for several days by the slow seepage of oil pocketed in the "shut" by pressure.

The view shows the pump operating with its usual smoothness, despite the cumbrous-appearing wrapping of chains—without the ingenious application of which the station would have been forced to shut down the unit and curtail its throughput seriously over the period required for casting, curing, machining, and shipping from the factory the replacement part.

**The Petroleum Engineer will welcome short articles of the type of the above. Perhaps in your daily work you, or someone in your organization, has devised an unusual and interesting way of accomplishing a task that, if written up, would prove of benefit to others. The "new wrinkle" may be a piece of equipment or an operating method and your description of it may be made as short or as long as the subject requires. Pictures or drawings to be used as illustrations will lend effectiveness. Articles found available for publication will be paid for at regular rates.—The Editor.**

# ANNOUNCING the NEW TYPE 12

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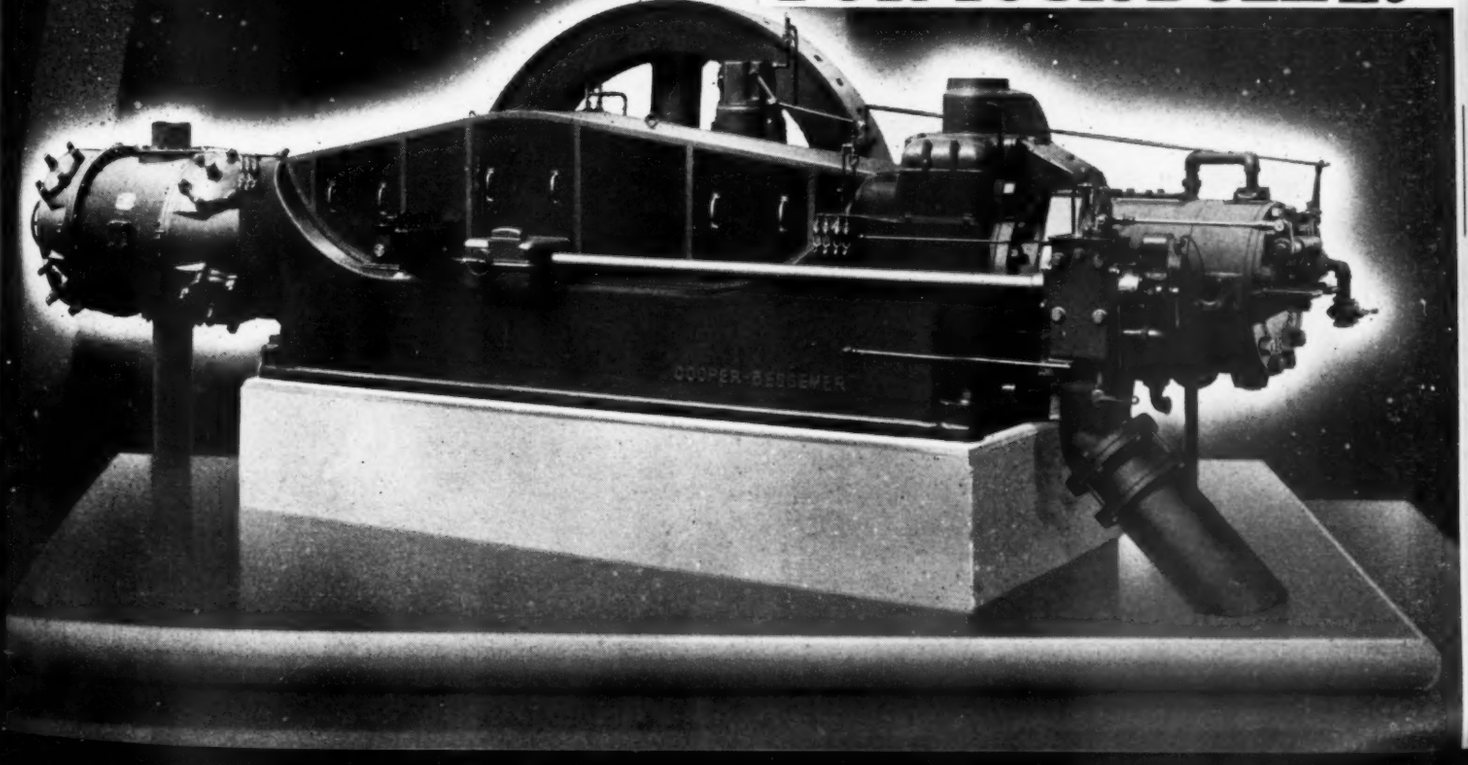


# The Manufacture, Packaging, and Shipping of Oxidized Asphalts

By CHARLES J. HOLLAND

Article 4

## Asphalt Plant No. 2

THIS is one of several asphalt plants of one of the major companies and in point of time is their oldest property, having been in operation some 35 years. It receives some of the charging stocks by coastwise and foreign steamers and ships out about half of its production the same way, this being both semi-finished and finished products.

The former are shipped in bulk via coastwise tankers to five or six of the company's Atlantic seaboard terminals. There they are blended with ingredients from other sources and the mixtures delivered into shell and pipe stills for steam and/or air reduction to finished asphalts. This affords flexibility and ease of attainment in meeting the diverse specification requirements of the northern and eastern states asphalt sales divisions.

The other half of the plant production moves out via railroad as finished products to inland markets or goes via pipe line to another of the company's refineries. The pipeline shipments are semi-finished products of light oil and heavy oil distillates, fuel oils and gas-oil cracking stocks.

The capacity of the refinery as a whole is 360,000 tons of asphaltic products per year. Just now the output is at the rate of 200,000, or approximately 60 per cent capacity. Seventy varieties of semi-finished and finished products are currently made.

The plant processes heavy crudes and residuums of Texas Coastal, Louisiana, Torrance California, Venezuelian, Columbian, and light and heavy Mexican origin. Due to existing high import duties, foreign crudes and residues are decidedly in the minority. For example, the asphalts made today are as a whole of ten per cent and less of Mexican stocks, whereas formerly they used maximum amounts of Mexican. The asphalts and road oils produced are steam-refined, air-blown, cut-backs and emulsified types.

There have been few changes during the past 15 years in the distillation and oxidizing facilities. Reduced operating costs and better quality products have been achieved through numerous minor alterations and improvements, but the fundamental features of the equipment are the same. The management recognizes that the oxidizing stills are obsolete but at present the presumption is that funds are not available for modernization. All operations are carried out in gas-fired and oil-fired horizontal shell stills of the atmospheric and high vacuum types,—high vacuum being introduced five or six years ago. Stills in which steam, but no air, is used are operated continuously.

### Facilities for Making Oxidized Asphalts. Compressed Air Plant

Fig. 7 shows in diagrammatic form the plant layout.

Other things being equal the preference is to produce all asphalts by air-blowing as opposed to steam-refining. Particularly as regards the temperature-susceptibility factor, oxidation gives a superior product. It is also much cheaper to manufacture.

Plant No. 2 compressed air production costs are unusually low because the steam turbine prime mover that drives the centrifugal air blower, operates at a 15-lb. gauge back-pressure and the exhaust steam therefrom becomes the process steam for the atmospheric and vacuum shell stills. The exothermic heat liberated when air-blowing will maintain partly or wholly the required temperatures during oxidation. Thus, fuel oil costs are also quite low compared to those for steam-reducing asphalt stills.

There are two machines for the compressed air production, one, the regular equipment and the other, the stand-by. The regular machine consists of a 450-hp. steam turbine operated with 120-lb. steam pressure and at 12-lb. gauge back-pressure. This is the prime mover for a one-stage centrifugal air blower that turns out air at 12-lb. gauge pressure. Turbine and blower are direct-connected and both operate at the unusually high speed of 11,000 r.p.m. The compressed air output is 7500 cu. ft. per minute. This machinery was made by The Elliott Company of Ridgeway, Pennsylvania.

The stand-by machine is a Worthington duplex steam-driven reciprocating single-stage 15x26x24 air compressor, equipped with Laidlaw feather-weight valves. It delivers 3410 cu. ft. per min. of air at 15-lb. gauge when running at 180-200 r.p.m.

### Oxidizing Stills

For the charging stocks used and the various grades of oxidized asphalts produced, the air consumption of Plant No. 2 varies from 1300 to 1800 cu. ft. per bbl. of charging stock, depending upon melting points of the asphalts required.

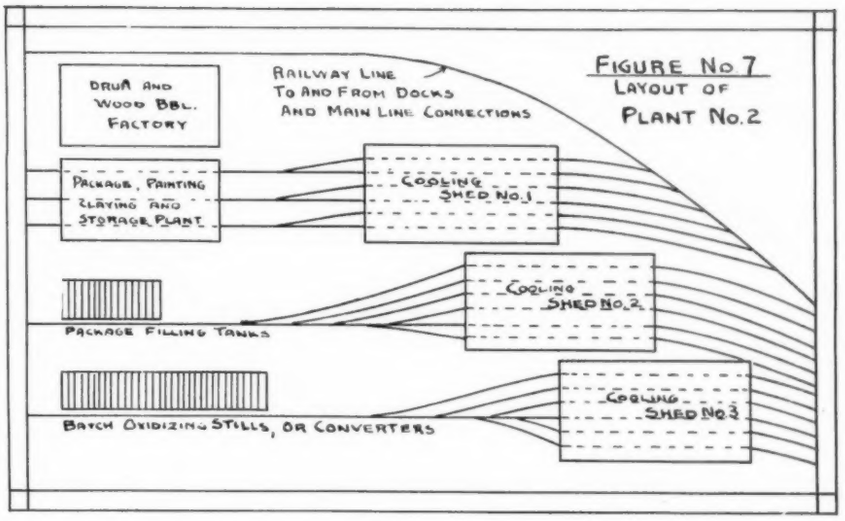
All oxidizing stills are of the horizontal, oil- and gas-fired, batch running type. Recently commercial experiments were conducted by the continuous method of operation. Only two stills were thus hooked-up, giving results partly successful and conclusive. The experiments were sufficiently demonstrative, however, to convince the management of the practicability, and the technical and economic soundness of the continuous operating method.

They are reluctant to do much along this line for two reasons. At this late date they realize and admit a horizontally placed still is in the incorrect position to get best results, and particularly so when operating continuously. They now understand and appreciate the reasons why some other people set oxidizing stills in a vertical position and why also that best results are had only where the ratio of diameter to height is small. Secondly, the orders received at Plant No. 2 are extremely variable as to specification requirements and many are for small shipments. Specifications have been

set up by their sales department, and are currently called for, for 32 distinct grades of oxidized asphalts.

Comparatively recently they have gone in for producing, at least partly, this great variety of products by the method of first making a few base stocks and subsequently blending them in proper proportions to produce all grades. This, of course, is the thing to do and it should eventually bring them to the continuous process of oxidation and entirely away from the more costly and less efficient batch type operation.

By other means during recent years they have been able to reduce operating costs and make better quality products. These were such things as better designed air spiders, indicating and recording pyrometers, better pumps, more thorough and efficient supervision and laboratory control, use of lower temperatures and air pressures.


DRUM AND WOOD BBL. FACTORY
RAILWAY LINE TO AND FROM DOCKS AND MAIN LINE CONNECTIONS
PACKAGE, PAINTING LABELING AND STORAGE PLANT
COOLING SHED NO. 1
COOLING SHED NO. 2
COOLING SHED NO. 3
PACKAGE FILLING TANKS
BATCH OXIDIZING STILLS, OR CONVERTERS
FIGURE NO. 7
LAYOUT OF PLANT NO. 2

There are altogether 31 horizontal batch oxidizing stills. They call them converters. Normally only 23 are operated. All are 9 ft. in dia. by 40 ft. long, and are charged with 67 tons of material to be oxidized.

All have air spiders of the conventional type similar to those found in steam-sprayed shell crude oil stills, with but one important exception. This relates to something they have learned about quantity of air holes. Formerly the custom was to perforate the air spiders with sufficient size and quantity of holes so that their total cross-sectional area was equivalent to one and one-fourth times that of the vertical air feed pipe leading down to the spiders from the air main line. Now they design so that this total cross-sectional area is equivalent to only two-thirds of that of the air feed pipe. This has resulted in giving a better quality of product, a shorter time cycle for the blowing period, and lower air consumption per ton of product.

They believe these better results are due to two things, namely, better distribution of the air and its better contact with the charging stock. They reason it out this way: With the old spider there were so many and so large perforations that the air not only came out nearly altogether in the center of the still close to the vertical feed pipe but also, due to the large holes, it came out under little or no compression in the bubbles. With the new spider design they believe these defects have been overcome, since the total cross-sectional area of the perforations and their individual size have been much reduced. Thus it is that the air tends to go uniformly through the entire spider lengths and at the same time to emerge from all the holes in bubbles more or less compressed. As these bubbles rise through the hot liquid they expand and thereby make for better and quicker contact with the body of the charging stock.

With the small size and number of perforations they have not noticed any increased amount of still cleaning as might naturally on first thought be expected. Another thing they now do and did not do formerly, is to blow out carefully the spiders and air feed line with high-pressure steam immediately after pumping out a batch of finished product. This has helped materially to reduce frequency of spider cleaning.

The converters are in brick settings, with fire boxes, combustion chambers, oil and gas burners, etc., in quite the same form and location as in the ordinary fire-heated crude oil shell still. Gas is the current fuel because of cheapness in price.

### Explosion Hatches

On the top and near the vapor line dome of each converter there are two circular spring-actuated explosion hatches, about two ft. in diameter, which are substitutes for the ordinary safety valves found on shell stills. Occasionally, though extremely infrequently, there is need to have it in good working order. When anything happens it is not in reality a violent explosion, but simply a mild muffled bumping sufficient to increase pressure in the converter above 35-lb. gauge, which is the pressure on the springs of the explosion hatches. The hatches relieve any excess pressure directly to the atmosphere.

### Vapor Disposal System

Some 10 to 12 ft. out in front of each nine or ten converters there are set up in series flow two vapor-scrubbing drums 4 ft. in diameter by 30 ft. high. Each contains six perforated baffle trays welded into position on angle-iron supports five ft. apart. Over them comes down from the top a full stream of water from a 1½-in. dia. supply pipe. The oxidized waste vapors and gases from the nine to ten converters pass upward from bottom to top of each drum in series and in countercurrent direction to the water flow. These vapors and gases reach the scrubbing drums by means of a 12-in. main line manifolded to all the vapor lines from the nine to ten converters in a set.

Out of the last drum the waste gases pass from the top by an 8-in. line thence to a 16-in. underground main line. This connects with all scrubbing drums for the 31 converters and enters at the bottom of a concrete stack 225 ft. high by six ft. in dia. at the base. Out of the top of this stack comes a white vapor. Due to the height it quickly dissipates into the upper atmosphere, leaving no noticeable odor in the neighborhood.

From the bottom of each vapor scrubbing drum a constant stream of oily water emerges through a 4-in. syphon pipe drawoff, set so as to maintain a 3-ft. liquid level in the bottom of each drum. This waste of oil and water goes by gravity flow to the refinery sewage and drainage system and finally into the oil trap where the oil is recovered for refinery fuel.

Due to the corrosive nature of the vapors and gases, the drums have their interiors covered with gunnite. Cast-iron baffle plates not protected were eaten out over a period of several months. The welded-in angle irons supporting them also when not gunnite-protected would eat out quickly.

### Cleaning of Stills

Converter cleaning is done by hand labor in the same fashion as with ordinary crude oil stills. When oxidizing

for products of 300 M.P. and higher it is often the case the converter must be cleaned after each run. For products of 180 to 250 M.P. they usually do 8 to 12 batches before necessity for cleaning.

Converter losses due to oxidation are:

| | |
|---|---|
| For products around 300 M.P. - - | 5 to 7 per cent |
| For products around 200 M.P. - - | 4 to 5 per cent |
| For products around 100 M.P. - - | 2 to 3 per cent |

They estimate an overall average to be 5 per cent.

In this connection, some years ago they made what was to them an interesting discovery: For years the standard charge to a converter had been a 7-ft. depth of hot liquid. Some one decided to speed things up a bit by a 7½-ft. charge. To his great surprise he got no more finished product than he did when charging a 7-ft. depth. What happened, of course, was that due to the great amount of foaming that takes place during the oxidizing period, the extra six in. of charge was lost through mechanical entrainment in the gases going out the vapor lines. This, incidentally, illustrates one of the very good reasons for building vertical stills of small diameter-height ratio. The greater the diameter as compared to height the less is the height of the column of foam per ton of charge and consequently the less mechanically entrained losses for a given depth of liquid charge.

### Charging Stock and Other Items

The charging stock for the converters is a product of 600 deg. fahr. minimum open-cup flash point and of about 1100 viscosity at 210 deg. fahr. Saybolt Universal Machine. The viscosity will vary up and down to some extent, depending on the crude from which the residuum comes. The charging stock is the residue left after distillation (usually under high vacuum) of the crude oils listed in the opening paragraphs. The charging stock may be a single residuum or it may be a mixture of two or more —the variety and percentage in the mixture being determined by the specification requirements of the finished products desired. The charge normally comes direct from the vacuum stills through a small cooling coil and reaches the converters at 300 to 400 deg. fahr. temperature.

The critical temperature for most charging stocks is around 640 deg. fahr., according to the management. Such temperature is, however, never gone to in the oxidation process, but may be used in the steam refining process. When oxidizing for the lower melting point products, up to 230 M.P., they can economically use maximum temperatures of 480 to 500 deg. fahr.; above 230 M.P. they require 540 to 560 deg. fahrenheit.

For temperature control each set of nine to ten converters has one Leeds-Northrup recording pyrometer having sufficient points to register separately on a paper roll the individual temperatures of the full set of converters it serves.

All pumping in and out of converters is done by steam-jacketed Kinney type S.D. rotary pumps for up to 150-lb. discharge pressure. From results of years of experience with numerous types and designs of pumps, Plant No. 2 some years ago standardized on this pump for all asphalt work where the pumping is not to be done under vacuum.

For vacuum service, such as pumping out the residuums of continuous high-vacuum shell stills, they have standardized on the Kinney steam-jacketed type B Heliquoid pump. Both kinds are direct-driven by vertical Troy steam engines. For very hot oils and asphalts they avoid speeds in excess of 120 r.p.m., particularly when pulling out of high-vacuum stills. Pump volumetric efficiencies decrease rapidly at speeds above 120 and also packing-gland trouble develops.

### Filling of Packages

When the 67-ton batch is finished and has been okayed by the laboratory it is transferred to one of a series of cylindrical, horizontally-placed package filling tanks. These are the same size, 9 x 40 ft., arranged for fire-heating underneath and in practically all respects of the same general appearance and performance as the oxidizing stills, or converters as they call them. Filling tanks are held under 30-lb. gauge air pressure in order to facilitate the filling of packages and to do it at lower temperatures than would be possible without air pressure, when comparing filling spouts of the same size.

The transfer is done immediately after finishing, if orders are on file, and by steam pressure on the converter. If there are no orders for immediate shipment the batch is pumped to storage. Storage tanks are from 1000-bbl. to 10,000-bbl. capacities and are lined on the outside with hollow-tile insulation. Closed steam-heating coils are on the inside at the bottom for heating of tank contents when necessary.

Mineral rubber, or asphalts of 300 to 350 deg. fahr. M.P. are never sent to storage. As soon as a batch is made it is blown over by steam pressure into its adjoining converter that has been previously arranged for drawing out into packages. Transfer is done through a wire screen bucket in order to catch and remove coke and solid particles before packaging. This side to side converter-package filling tank arrangement is carried out so as to avoid all possibility of plugging

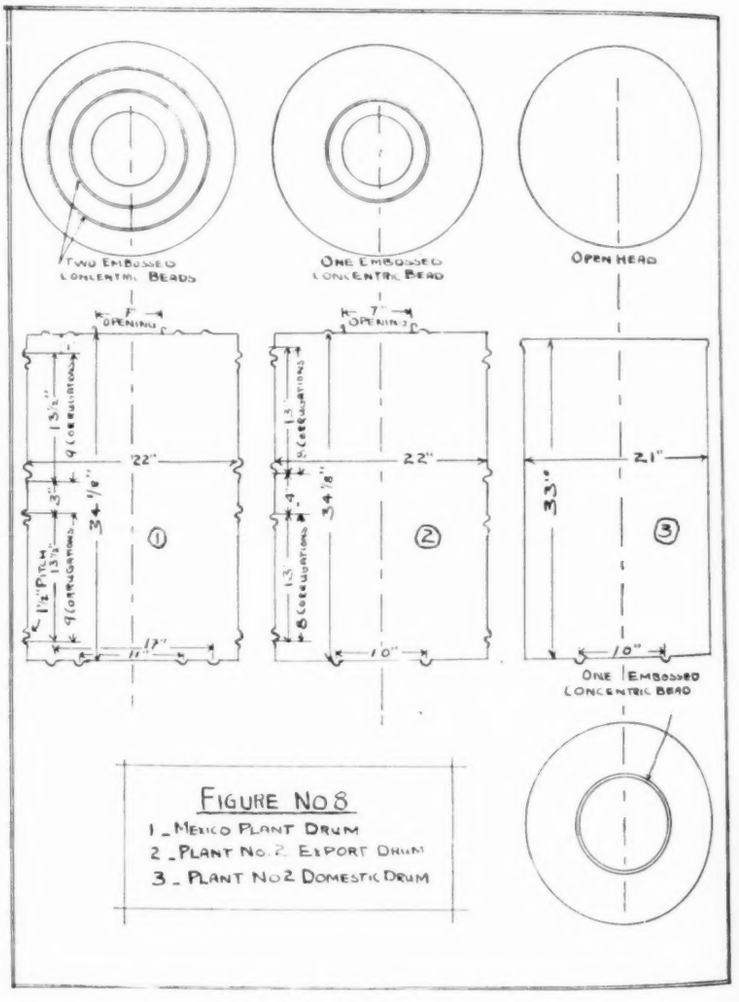



FIGURE NO 8
1 - MEXICO PLANT DRUM
2 - PLANT NO. 2 EXPORT DRUM
3 - PLANT NO 2 DOMESTIC DRUM

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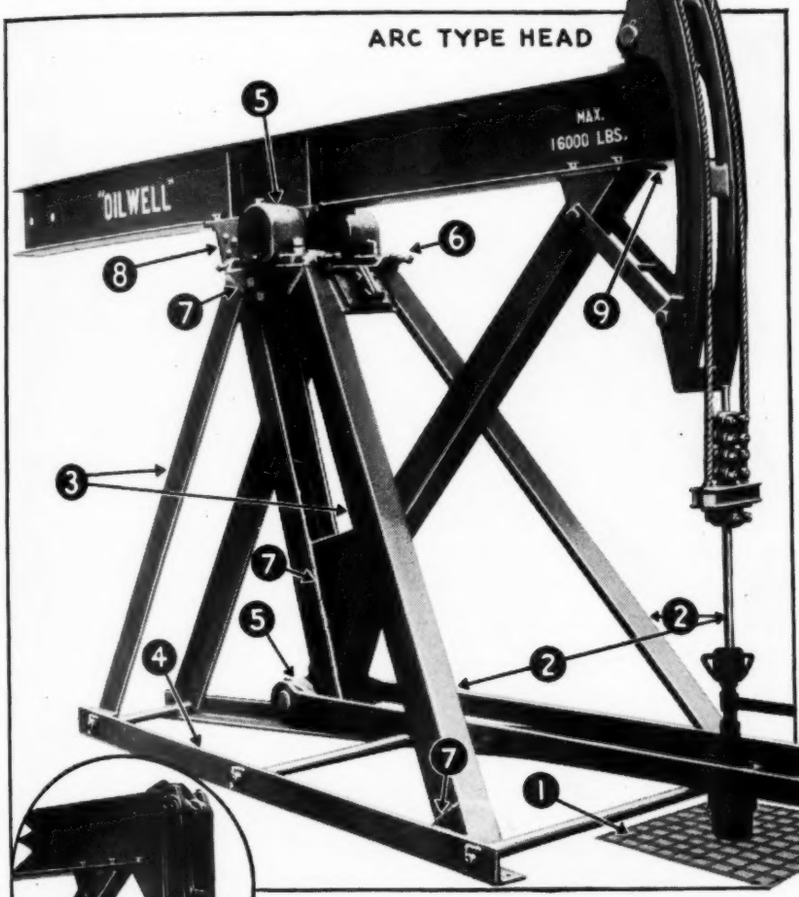


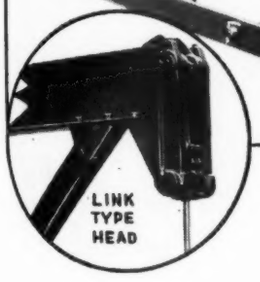


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up of line and connections, such as would be present were the transfer made to a more distant package filling tank.

Immediately in front of a series of package filling tanks there is a standard gauge railway track upon which are transported a train of flat cars, each holding 21 drums or barrels. This train of cars, after receiving from the storage shed a load of empty packages, is brought up by locomotive alongside of the package filling tanks. (See Fig. 7). Here the locomotive disconnects, leaving the first flat car with its 21 empty packages spotted exactly in front of the tank from which the train-load of empties is to be filled.

The filling tank operator thereupon connects up the entire train, hooking on to the first car with a wire cable that has its other end bound to the drum of a steam winch located some 100 ft. or more ahead and in front of the first car. The operator riding on the first car has control over the winch by means of a remote control steam valve located within his arm's reach. Thus he can do two things at once: By opening up the package loading spouts he fills the first 3-in.-line packages on the flat car and when they are filled he opens up the steam throttle on the winch by the remote control valve. In this way he simultaneously fills the packages and moves the cars up to the filling spouts. It is seen, therefore, that once the train-load of empties has been spotted for loading by the locomotive crew, one man does all the filling and necessary movements by steam winch of the entire train-load. When the operator completes the filling of a train of empties he signals to the locomotive crew, who come and get it and take it to one of the three cooling sheds, a distance of several hundred ft. away.

The train remains in the shed three or four days and then is returned for the "topping off" operation. When that is done it goes once more to the cooling shed for sealing and stencilling of grades and serial numbers. Finally, it is weighed, drum by drum, and sent to storage, to railway cars or to the docks for water shipment.

### Cooling and Storage of Filled Packages

As shown in Fig. 7, there are three covered sheds for this purpose, each with six standard gauge railway sidings. Each siding holds 24 flat cars of 21 packages each. The total flat car capacity is, thus:

$$24 \times 6 \times 3 = 432.$$

The total package capacity of the three sheds is:

$$6 \times 24 \times 21 \times 3 = 9072.$$

Figuring this all on basis of export iron drums and calculating five drums to the ton, the total tonnage capacity would be:

$$\frac{9072}{5} = 1814 \text{ tons.}$$

Under maximum hot weather conditions and assuming necessity for "topping off" of all packages, not less than four days would be required for filling, cooling, "topping off," sealing, stencilling, and weighing. Hence, with these conditions prevailing, the daily capacity of the three sheds would be:

$$\frac{1814}{4} = 453.5 \text{ tons.}$$

Calculating the overall dimensions of a flat car at 7 ft. wide by 20 ft. long, times 24 would give a shed length of 280 feet. For shed width, it is assumed there is a space of one ft. between car trains and a 3-ft. space on the outside edges of the first and last train. Hence:

$$(7 \times 6) + (1 \times 5) + (3 \times 2) = 53 \text{ feet.}$$

Therefore, the total area of the three sheds would be $280 \times 53 \times 3 = 44{,}520$ sq. ft., indicating that approximately five sq. ft. is needed per drum for cooling and storage:

$$\frac{44{,}520}{9{,}027} = 4.98.$$

### Manufacture of Packages

In addition to the above mentioned facilities, there are the plants for the manufacture, painting, claying, and storage of wooden barrels and iron drums.

The demand for shipments in wooden barrels is growing constantly less so that today only a small quantity are used. They go to a few customers in France and England who prefer the wooden package because of ease of stripping down and also for the wooden staves for use in kindling fires under small movable asphalt melting pots used in roadway patch work. Wooden barrel shipments are in fact almost negligible when compared with the total of shipments in iron drums, in tank cars, and in bulk movements via coastwise tankships.

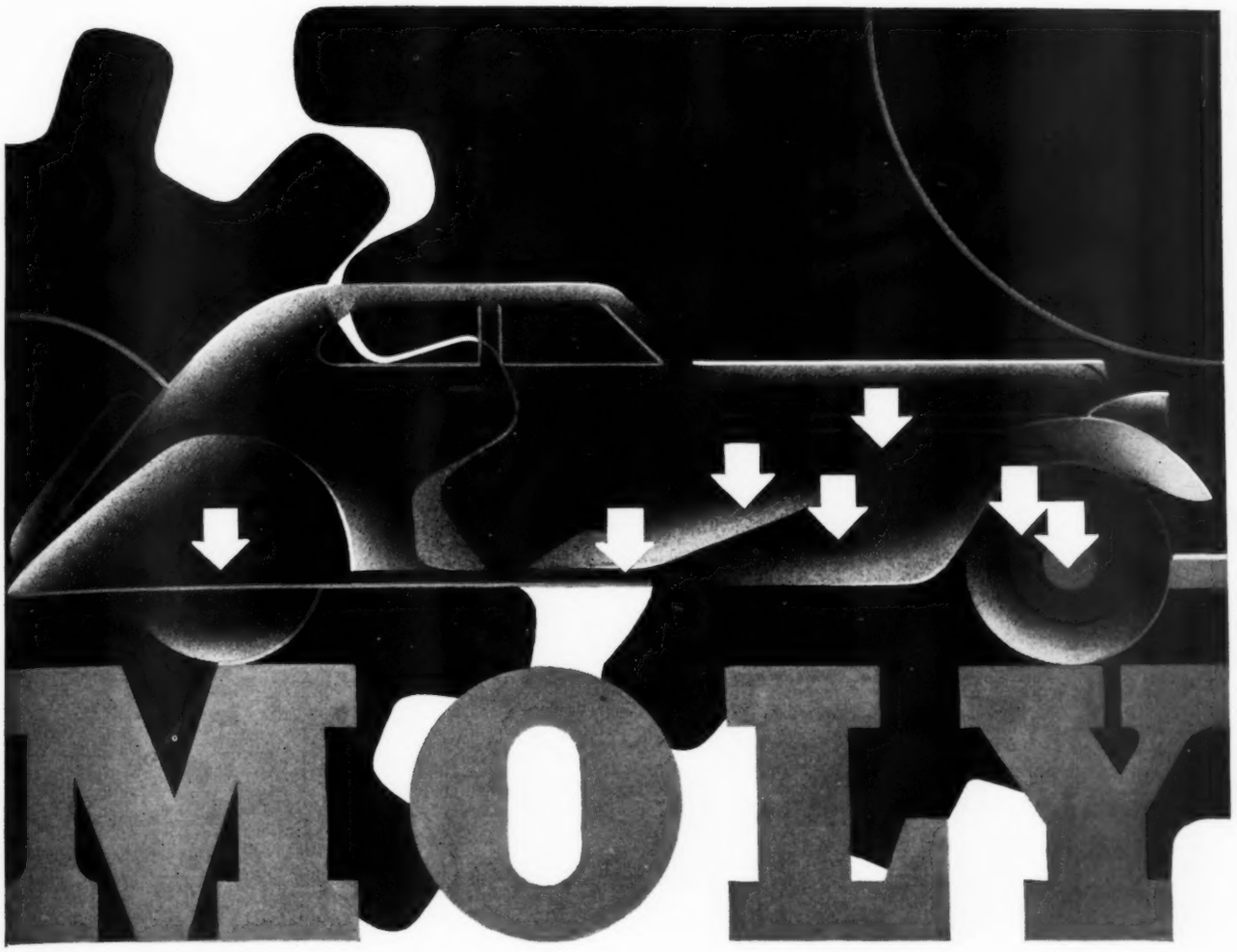
What wooden barrels made are not of the tongue-and-groove type, as used by an asphalt plant in Mexico. The management reports having conducted exhaustive tests with tongue-and-groove and with plain-edged staves, and did not find sufficient difference to warrant the additional cost of tonguing-and-grooving. The tests made consisted of placing both types of wooden barrels, side by side, filled with the same grades of asphalts and exposed to all kinds of weather and handling conditions. They were left out for weeks in the weather, hot, cold, wet, and dry, and were subjected to all the usual handling methods. They report that when testing with comparatively low melting point asphalts, both types of barrels after alternately contracting and expanding eventually became leaky packages in about the same degree and in about the same period of time. From these tests they concluded that tongue-and-groove staves for asphalt wooden barrels were pretty much a waste of money.

The one improvement they have made in the wooden barrel package within recent years is the substitution of iron-wire hoops for wooden hoops. The iron wire is heavy and runs in an up-and-down waving direction (like a corrugation) around the barrel, and not in a straight line. This way they get a tighter package at less cost than was the case when using wooden hoops.

Besides the occasional making of one or two smaller sizes, the iron drum factory output consists of two varieties of standard-sized drums. They call them the export drum and the domestic drum.

The domestic drum, which has a bottom but no head, is of 24-gauge metal throughout. It is without corrugations in body but does possess at the very top a ½-in. deep chime. This gives considerable additional strength to the open head, minimizing distortion during filling, handling, and shipping. The chime is pressed in at the same time the bottom is clenched in place by a special machine designed and built by the plant engineers. This is the first and only machine of its kind over built. The management is now negotiating with one of the drum machinery builders to arrange for placing the machine on the market. The body of the domestic drum utilizes the regular stove-pipe seam.

The body of the export drum may be 28- or 26-gauge metal, depending on melting points of products shipped. For




# puts vitality into carburizing steels

REAR-END and transmission gears, pinions, cam and crankshafts, spindles, wrist and steering-knuckle pins . . . more is demanded of them than ever before in the history of the automotive industry. Many of the steels on the market are suitable for the carburizing required for such parts facing the stress of high speed, shocks and the fatigue of long periods of continuous heat and action.

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There is also, of course, the 3.5% Nickel Molybdenum steel for similar, but heavier-duty applications.

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**CLIMAX Mo-lyb-den-um**

the higher melting points above 250 deg. fahr. they use 28-gauge and for the lower, the 26-gauge metal. All heads are invariably of 24-gauge metal. This drum has the new Niagara seam, as now used in the Mexico plant.

The capacity of the drum factory is 250 drums per hr. of export variety and 400 per hr. for domestic drums.

The chief characteristics of the Plant No. 2 drums and of the Mexican plant drum are shown in Fig. No. 8.

### Painting, Claying, and Storage of Empty Packages

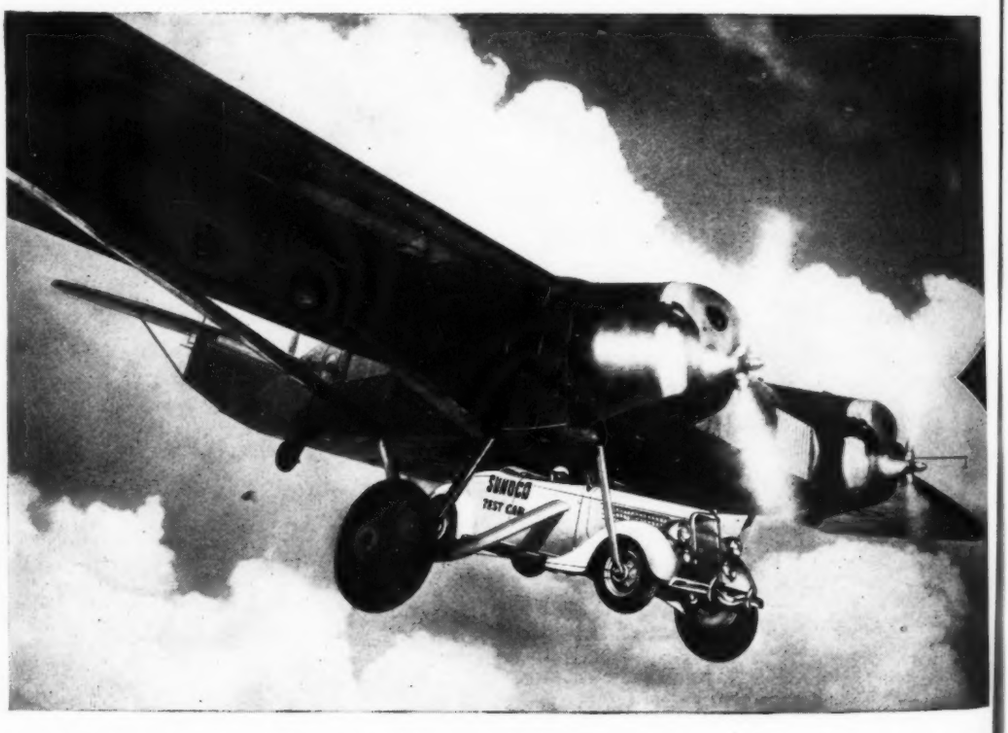
As drums are manufactured they go via vertical elevator on to a gravity flow chute that delivers them to the adjoining building—the shed for painting, claying, and storage of empty packages, as shown in Fig. 7.

Here from the two different chutes—one for export and one for domestic drums—operators take the drums into a specially arranged small housing where they give them simultaneously the paint coating on the outside and clay coating on the inside. The drums are set upon a hand-revolving table in the center of which is a spout shooting upwards through which comes the clay-water-air emulsion by means of compressed air turned on through a foot valve on the floor level. While the operator has his foot on the clay-air valve he is at the same time spraying with paint-air gun the outside top, bottom and body of the drum. This whole operation only takes about one-half minute, after which the drum is pitched out of the housing onto the floor where another man catches it, gives it a roll and at the end of the shed it finally comes to rest, for stacking and storage.

All the above equipment and operations take place on the second floor. On the ground level underneath there are two railway sidings, as indicated in Fig. 7. On them are placed two trains of empty flat cars and by means of simple home-made chutes the drums come down from second floor storage to be set in place on flat cars, ready for delivery to the package filling tanks.

# Test Quick-Starting Quality of Gasoline Mile in Air

AN interesting test was made recently by the Sun Oil Company demonstrating the quick-starting quality of its "Blue Sunoco" gasoline. A Ford roadster, fastened and braced with struts between the wheels of the landing gear of a giant Uppercu-Burnelli transport plane at Floyd Bennett Field, New York, was taken a mile in the air, where the atmosphere is rarefied, the cold intense, and the winds strong. The test was made in February when the weather is extremely cold in the eastern portion of the United States.




Piloting the plane was Lou Reichers, and with him was Zeke Meyer, auto racer. An observation plane accompanied the sky-giant to check the test. A mile above the earth, Meyer opened a trap-door in the floor of the plane, and slid downward into the seat of the roadster beneath him. The temperature was below zero, the speed of the plane 130 miles an hour. Under these conditions Meyer pressed the starter, and as he did so, a bright light by the windshield flashed on. As long as the starter pedal was down the light remained on, so those in the accompanying observation plane could time the test. The motor started at the first touch of the starter, Meyer meshed gears and the rear wheels, fitted with spiral-painted discs, so their motion would be immediately observable, began to spin.

# Program for Mid-Year Meeting A. P. I. at Tulsa

MANY papers, chiefly technical in scope, will be presented at the American Petroleum Institute's fifth mid-year meeting, to be held in Tulsa, Oklahoma, May 14, 15, and 16, at the Mayo Hotel. In addition, committee meetings and the regular sessions of the board of directors will be held. The program, which follows, calls chiefly for divisional sessions, with no general session scheduled.

### Wednesday, May 15, 1935

9:30 A. M.

### PRODUCTION DIVISION

DRILLING AND PRODUCTION PRACTICE: (16th Floor—Crystal Ball Room)

(Sponsored by the Central Committee on Drilling and Production Practice.)

Presiding: W. T. Doherty, Humble Oil and Refining Company.

*Drill Stem*—H. W. Fletcher, Hughes Tool Company.

*The Development of Rotary Drill Pipe*— H. W. Graham, Jones and Laughlin Steel Corporation.

10:00 A. M.

### REFINING DIVISION

REFINING SESSION: (Mezzanine Floor—Junior Ball Room)

Presiding: E. W. Isom, Sinclair Refining Company.

*Fuel Specifications for High-Speed Diesel Engines.*—

*a. General Presentation*—G. C. Wilson, University of Wisconsin.

*b. Round-Table Discussion*—Participated in by engine and fuel manufacturers.

*Oiliness in Motor-Oil Practice*— D. P. Barnard and E. R. Barnard, Standard Oil Company (Indiana)

*Polymer Gasoline from Cracked Gases*—V. N. Ipatieff, and Gustav Egloff, Universal Oil Products Company.

### Wednesday, May 15, 1935

2:00 P. M.

### PRODUCTION DIVISION

DRILLING AND PRODUCTION PRACTICE: (16th Floor—Crystal Ball Room)

(Sponsored by the Central Committee on Drilling and Production Practice.)

Presiding: T. V. Moore, Humble Oil and Refining Company.

*Selective Wetting of Reservoir Rock and Its Relation to Oil Production*—Allen D. Garrison, Rice Institute.

*Technique of Securing and Examining Sub-surface Samples of Oil and Gas*—Ralph J. Schilthuis, Humble Oil and Refining Company.

*Sub-surface Pressure Instruments* (Review)—D. G. Hawthorn, Amerada Petroleum Corporation.

2:00 P. M.

### REFINING DIVISION

REFINING SESSION: (Mezzanine Floor—Junior Ball Room)

Presiding: A. E. Pew, Jr., Sun Oil Company.

*The Chemical Constitution of the Gasoline Fraction of Petroleum*—Frederick D. Rossini, National Bureau of Standards.

*Fundamental Research on the Chemical Constitution of Lubricating Oil*—Frederick D. Rossini, National Bureau of Standards.

*Determination of Monthly Gasoline-Production Allowables*—Fred Van Covern, Planning and Coordination Committee.

*Laboratory Distilling Apparatus*—W. W. Scheumann and J. F. Stewart, Empire Oil and Refining Company.

### Thursday, May 16, 1935

9:30 A. M.

### PRODUCTION DIVISION

DRILLING AND PRODUCTION PRACTICES (16th Floor—Crystal Ball Room)

(Sponsored by the Central Committee on Drilling and Production Practice.)

Presiding: D. R. Knowlton, Phillips Petroleum Company.

*Cementing Methods for Excluding Water from Producing Wells*—R. E. Watson, Humble Oil and Refining Company.

*Electrical Exploration of Drill Holes*—Alexander Deussen, Consulting Geologist, and E. G. Leonardon, Schlumberger Well Survey Corporation of Texas.

*Methods for Determining How Much of a Frozen or Cemented Column of Pipe is Free*—J. T. Hayward, Barnsdall Oil Company.

10:00 A. M.

### REFINING DIVISION

PROGRESS IN SOLVENT REFINING: (Mezzanine Floor—Junior Ball Room)

Presiding: L. W. Parsons, Tide Water Oil Company.

*Recent Developments in Selective Solvent Extraction with Chlorex*—D. B. Williams, Carbon and Carbide Chemical Corporation.

*Performance and Flexibility of the Duo-Sol Process*—Malcolm Tuttle, Max B. Miller Company.

*The Refining of Lubricating Oils with Furfural*—G. R. Bryant, Indian Refining Company; R. E. Manley, and B. Y. McCarty, The Texas Company.

*Analytical Solvent Fractionation of Lubricating Oils.*—U. B. Bray, R. C. Pollock, and D. R. Merrill, Union Oil Company of California.

*Service Characteristics of Motor Oils as Related to Composition*—D. R. Merrill, C. C. Moore, Jr., and U. B. Bray, Union Oil Company of California.

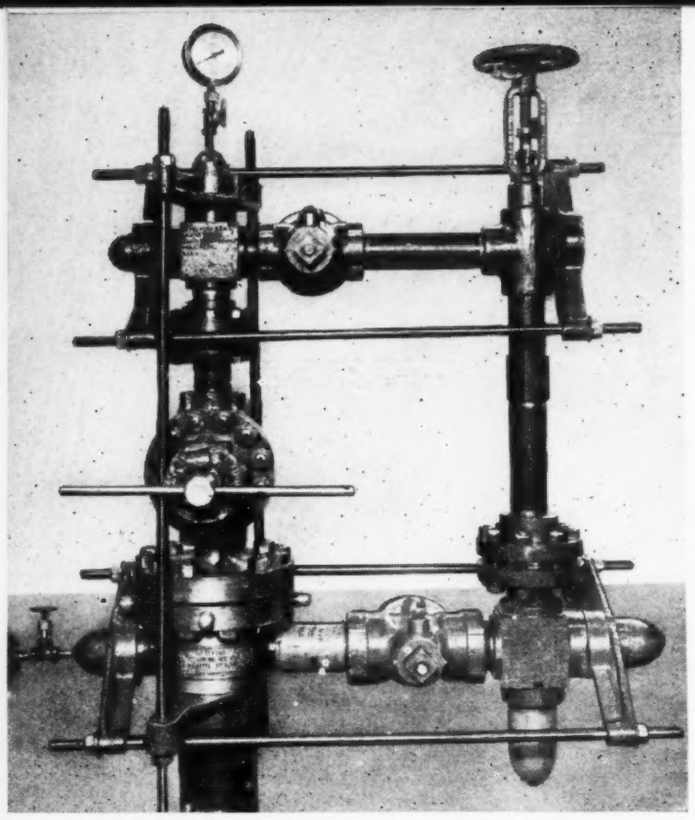


Fig. 1. High-pressure Christmas tree with plug valves, tubinghead, and adjustable choke undergoing pressure tests before being shipped to the field

By

K. C. SCLATER

# Handling High-Pressure Wells in the Mid-Continent

IT was not until the development of the Oklahoma City field that the handling of high-pressure wells in the Mid-Continent assumed importance. High pressure is one inevitable concomitant of deep development operations. Pressure in itself does not mean much; it is the subsurface conditions under which pressure exists that determine the precautions that must be taken to keep control of a well during drilling and the subsequent flush production period. When the oil underground is associated with a prolific source of high-pressure gas such as was found in the Oklahoma City field, a hazard is set up that is far greater than that when little or no gas accompanies the oil.

High-pressure gas suddenly released in large volume may result in dangerous flow velocities at the casinghead. If the gas and oil carry any solids such as fine sand, the danger is increased many fold. Such a condition actually obtained during the development of the Oklahoma City field and led operators to equip their wells securely against high casinghead pressures. Productive horizons in this field lie at a depth of more than 6000 ft. and consequently high initial reservoir pressures (2350 lb.) were encountered.

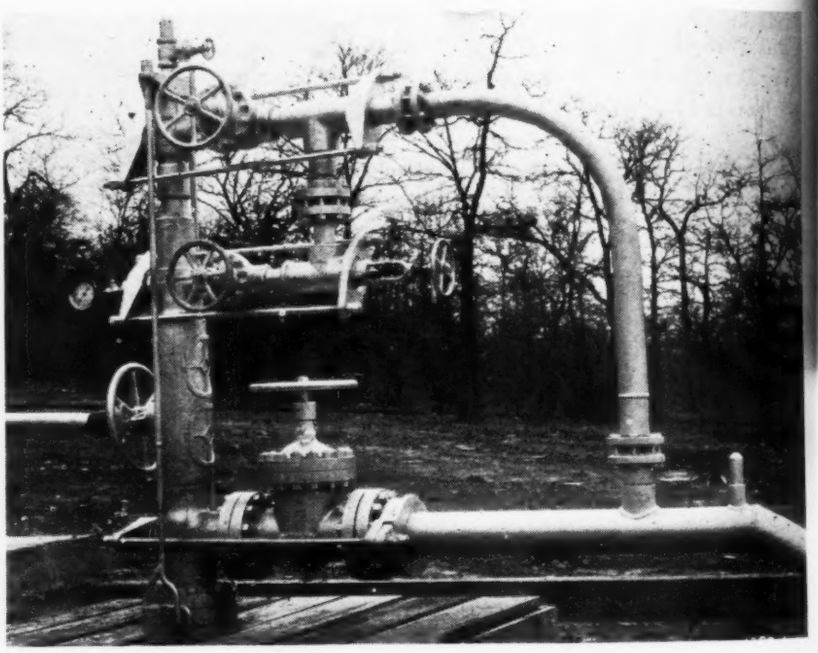


Fig. 2. High-pressure Christmas tree with retractor head on a flowing well in the Fitts pool

With the exception of some trouble encountered in the Fitts pool, caving troubles in the Mid-Continent during drilling such as encountered in the fields of the Gulf Coast are practically absent. The necessity does exist, however, for exercise of care in drilling and also during the period of flush production.

In considering high pressures in the Mid-Continent it should be borne in mind that a high bottom-hole pressure does not necessarily create a hazard at the casinghead. If no high-pressure gas sands are open to the well and the natural gas-oil ratio is low, there is little likelihood of a well getting out of control. Even in a deep well of this type with a high bottom-hole pressure the pressure likely to be observed at the casinghead will be that built up when the hole is standing full of fluid, and would be that due to a water-drive pressure in excess of the hydrostatic pressure exerted by an open column of water in the hole.

Casinghead connections on drilling wells in the early days of the Oklahoma City field development had to be secure against blow-outs. These connections usually consisted of

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master drilling gate on the casing above which one, and sometimes two, control gate valves of the ram type that close around the drill pipe, were used. When a well was placed on production it was equipped with pressure control equipment in the form of control gate valves with rams that close around the tubing. A good example of secure cellar connections on a high-pressure flowing well in the Oklahoma City field is shown on Fig. 4. When this hook-up was installed some four and a half years ago the pressure of the well was approximately 2100 lb. and required secure casinghead connections to prevent vibration of the Christmas tree when the well was flowing. In this hook-up an American Casing Suspender with tie-down from the casing spider to a tie-down companion flange between the two flanged gate valves shown, is used to brace the high-pressure casinghead connections. Fig. 7 shows a high-pressure hook-up on a flowing well in the Oklahoma City field. These hook-ups are typical of the means taken to control high-pressure wells in the Oklahoma City field.

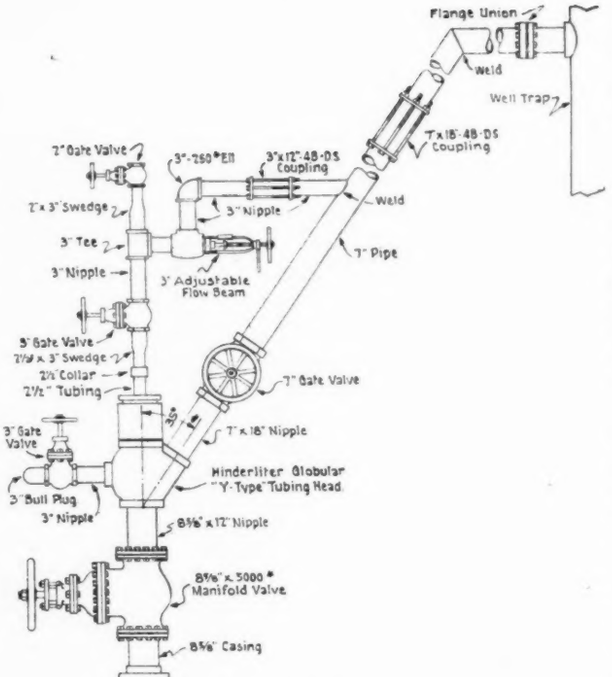



**Fig. 3. One of the high-pressure hook-ups of standard design in use on flowing wells in the Fitts pool, Oklahoma.**

In the Crescent and Lucien fields the original bottom-hole pressure was high (2200 lb.) but gas-oil ratios were low enough that with ordinary care no serious difficulties with high pressure have been encountered; nevertheless operators in these deep fields take every precaution to avoid trouble by using high-pressure equipment.

In the Fitts pool, the original bottom-hole pressure was approximately 1900 lb. and the natural gas-oil ratios are sufficiently high to require care and close control in drilling. Also in some parts of the field the formations have a tendency to cave. The average depth of wells is 4200 ft., and gas sands encountered, although not under high-pressure, are prolific enough to cause trouble while drilling.

Mud control in this field has received considerable attention. In certain parts of the field blow-outs have occurred. Salt water encountered dilutes the drilling mud and vitiates its properties sufficiently to cause gas from upper gas horizons to enter the well while drilling. Thief sands in the upper part of the hole, by loss of circulation, have also caused gas to

**Fig. 4. A good example of secure cellar connections on a high-pressure well in the Oklahoma City field**

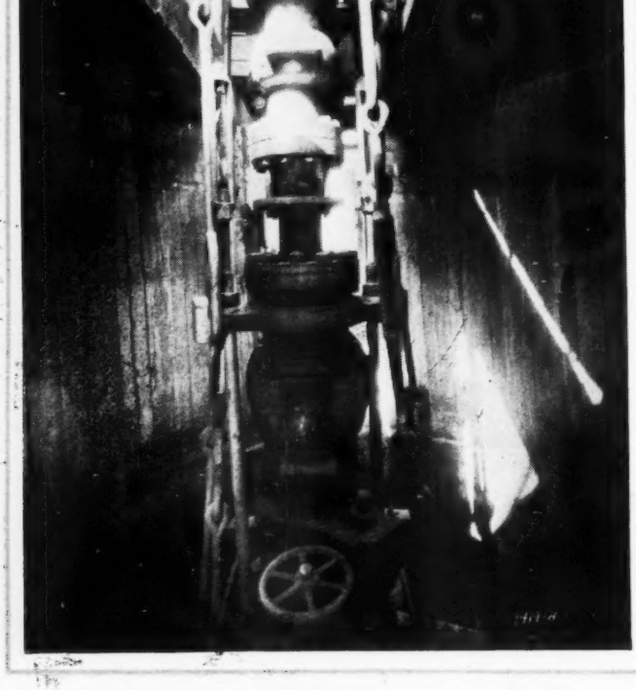
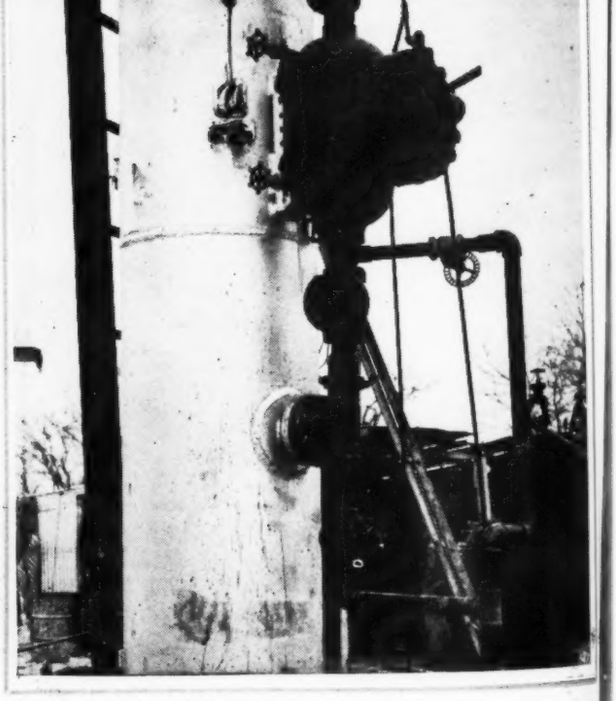


**Fig. 5. Liquid level control connections of water knockout in pressure-drilling hook-up on well in Fitts pool. (See Fig. 8)**



come into the hole. Brecciated subsurface conditions have possibly contributed to this trouble. Even though the pool is not very deep, the average bottom-hole pressure not unduly high, and the natural gas-oil ratio not too great, the other subsurface conditions that prevail necessitate extra precautions being taken to keep wells under control.

One of the operators in this field has adopted a practice—somewhat of an innovation in Oklahoma—of drilling-in his wells under pressure. In using this method the object is to obtain more accurate information regarding the position and productivity of productive horizons and to protect the pay sands from being penetrated by drilling fluid while drilling-in. Details of the drilling fluid (water) circulating and separating system are given in Fig. 8. On the pump discharge (shown in the right lower corner of Fig. 8), gas is injected to lighten up the drilling fluid column in the hole. It has been found possible to inject sufficient gas to lighten up the drilling fluid (water) to weigh approximately 4 lb. to the gallon. The amount of gas injected depends on the differential pressure desired between the fluid column and the pay sand being penetrated. Circulation returns containing the injected gas cuttings and any oil or gas production is led into the water knockout shown at the left (Fig. 8), the water from which is dumped automatically into the 8 x 10 tank shown at the right. Any oil or gas produced by the well goes out the line from the top of the water knockout through a choke. Adjustment of this choke regulates and maintains the pressure on the water knockout to the desired amount. The oil and gas from the separator is led off as shown. Any water coming over with the oil and gas is dumped automatically into the 8 x 10 tank.

The whole system, including the 8 x 10 tank, is practically full to begin with. All the drilling fluid (water) is discharged from the pump down inside the drill pipe in the well and back up outside the drill pipe and into the water knockout, from which it is discharged into the 8 x 10 tank, to which the pump suction is attached. The sys-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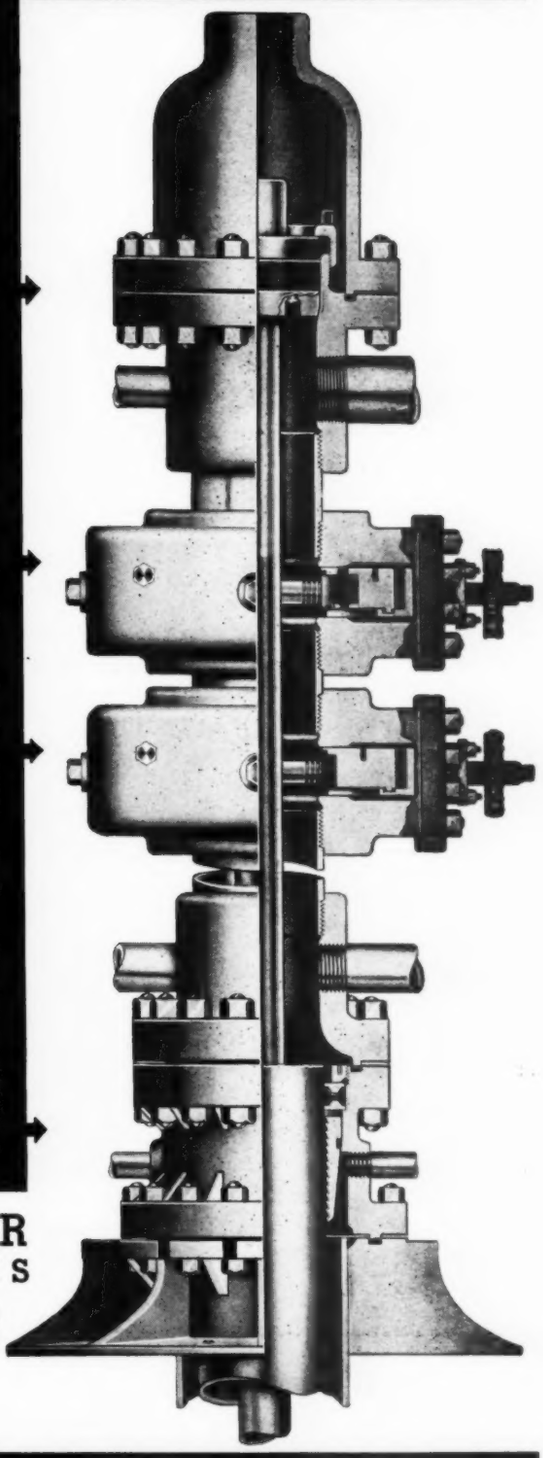

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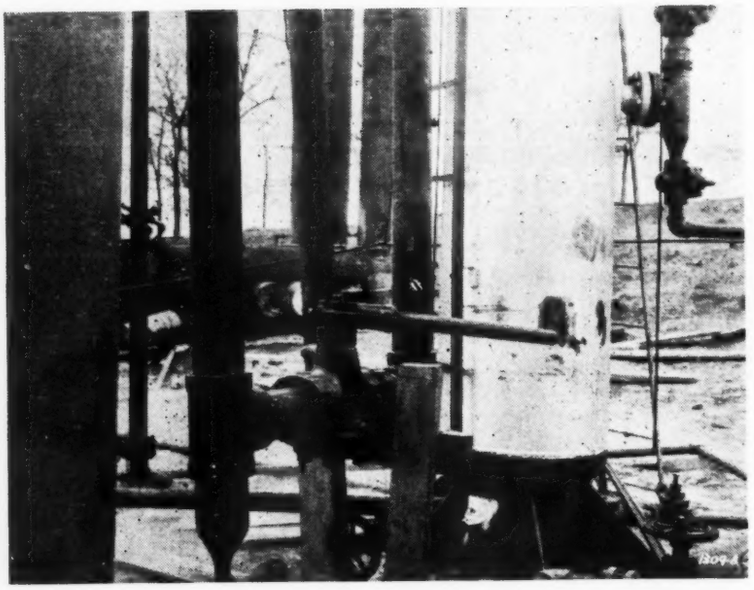


**Fig. 6. Control valve between the water knock-out and the oil and gas separator on pressure-drilling hook-up in Fitts pool. (See Fig. 8)**

Christmas trees in use on flowing wells in the Fitts pool are shown in Figs. 2 and 3. In Fig. 1 the top flange of the tubinghead forms the base of the Christmas tree. This tubinghead is of forged steel to withstand high pressure. The lower flange of this head is used while drilling-in, being surmounted by a drilling valve or a blowout preventer with an opening the full size of the casing. Tubing is then run in the well through the blowout preventer and suspended on a mandrel type hanger that forms a ground joint with a seat in the lower flange. With this head the well is under control at all times. When the tubing, which is blanked off, is landed with the mandrel hanger in the lower flange, flow is securely shut off between the tubing and casing.

tem is closed, and unless formations take up some of the water no drilling fluid need be added. Drilling samples are taken from the knockout through a valve on a line at the left lower corner.

Samples of the formation cuttings may be drawn from the knockout through a valve on a line shown in the left of the sketch (Fig. 8). On an 8500-ft. hole, using a gas input of 500 cu. ft. per day, and drilling at the rate of not greater than six ft. an hour, the formation samples can be calculated within two ft. of their exact original depth by checking the time the sample was taken.

The 8 x 10 tank is especially designed to provide a means for drawing of cuttings that may pass over from the knockout through the lower valve at right (Fig. 8), and also to care for cuttings and water from the separator when operating with low or no pressure on the water knockout.

This tank may also take the place of a mud pit, and all oil produced may be circulated with the oil if desired. By this means full control of the well is maintained at all times while drilling-in.

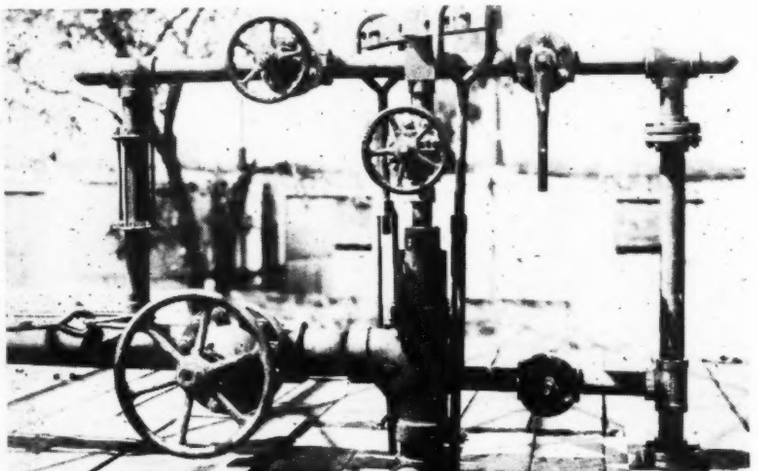


**Fig. 7. High-pressure hook-up on flowing well in the Oklahoma City field**

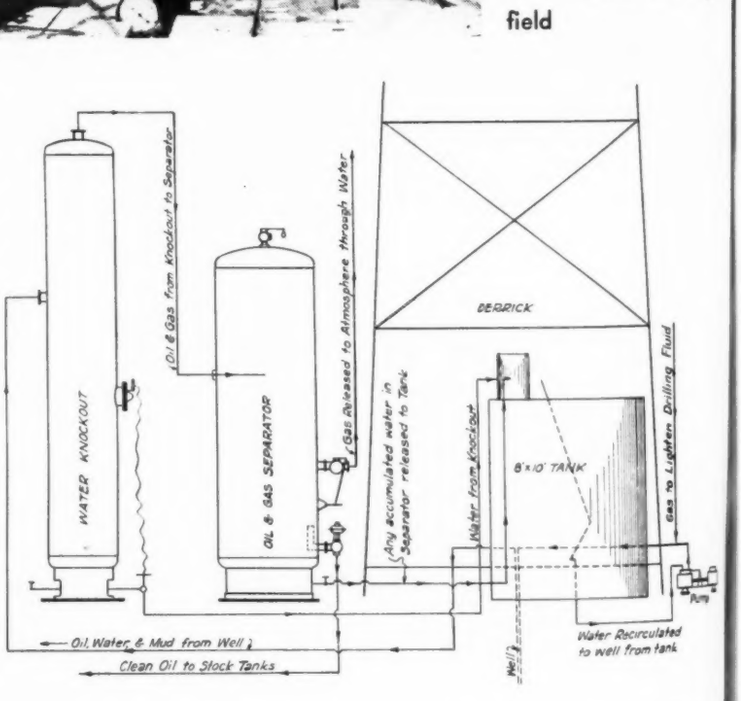
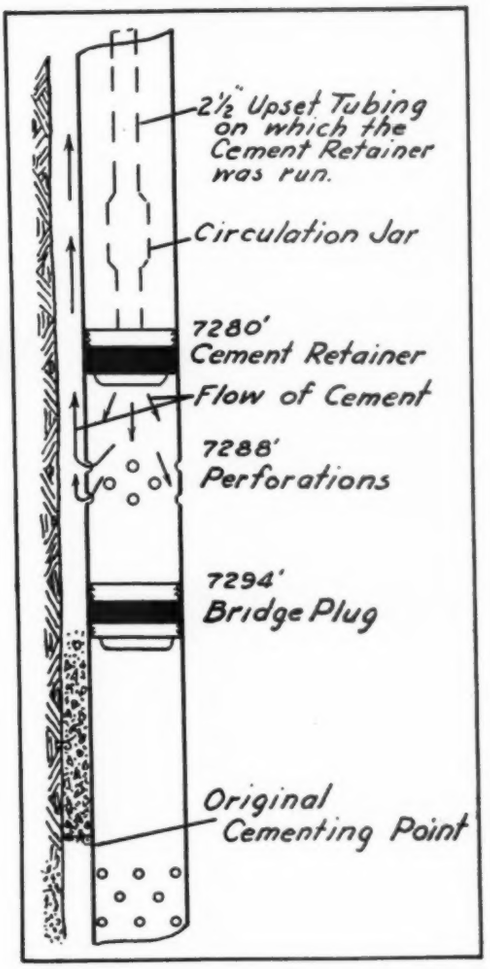

WATER KNOCKOUT
OIL & GAS SEPARATOR
Oil & Gas from Knockout to Separator
Gas Released to Atmosphere through Water
Any accumulated water in Separator released to Tank
Water from Knockout
DERRICK
8'x10' TANK
Gas to Lighten Drilling Fluid
Pump
Oil, Water, & Mud from Well
Clean Oil to Stock Tanks
Water Recirculated to well from tank

**Fig. 8. Sketch showing details of drilling fluid circulating and separating (National Tank Co.) system used in Hydril pressure-drilling operations in Fitts pool**

Fig. 1. Recementing a combination liner above the original cementing point




# Recementing and Repair Work in Wells . . . Methods of Overcoming Special Problems

By

WALLACE A. SAWDON

Petroleum Engineer, Los Angeles

RECEMENTING jobs and the repair of wells with cement usually present problems that are more difficult of solution than the original cementing of a string of casing. While the mechanical process of handling the cement and putting it down the well are practically the same in all cases, special equipment is often necessary in placing the cement where it will be effective. On many occasions, obstacles are present in recementing and repair work that can be overcome only by the use of such special equipment.

The technical phases of this kind of work are usually of particular importance. A knowledge of conditions existing down the hole is necessary; and on this knowledge must be based the entire operation. A recementing job, of course, is not always concerned with the well history. Repair work, on the other hand, usually is; and before any plans are made, all drilling and production data should be thoroughly studied. The production record may show the cause of trouble and the drilling record should help disclose the condition of the hole. All geological data should be carefully examined; they often tell the "why" and the "where" of trouble. The complete casing record must, of course, be given thorough study.

The greatest obstacle generally encountered in both recementing and repair work is lack of free circulation. Sometimes on a recementing job no circulation whatever can be obtained; and in order to get a shut-off, as much cement as possible must be forced around the shoe under pressures that are often extremely high. These "squeeze" jobs are often the only means possible for recementing; yet there are times when circulation is actually broken at the pressure necessarily applied to force the cement behind the casing. Circulation thus obtained can usually be continued at lower pressures and if the cementing equipment is such that the circulation can be utilized before the cement is introduced, the recementing can be done more effectively and, in many cases, with more permanency.

In most repair work, circulation behind the casing from the point of repair to the top of the hole is seldom possible. Yet circulation behind the casing for some distance above the point where cementing is to be done can frequently be obtained; and this circulation is all that is necessary to put the cement behind the casing where it is desired. The exact amount of cement that the job will take, however, cannot always be closely estimated; and since any excess cement must be disposed of without harmful effects, the equipment used must provide for all requirements.

## Special Cementing Equipment

Cement retainers have been used for years; yet it is doubtful if the scope of their application has been realized. One important adaptation is for cementing where no circulation is available. Being run on drill pipe or tubing, they provide for the use of high pressures, and, because of a back-pressure valve, keeping the pressure on the casing at the surface after the cementing job is finished is not necessary. The tubing or drill pipe on which the cement retainer is run and operated is unscrewed as soon as the cement is in place and any cement is circulated out of the tubing or drill pipe immediately. The removal of tubing or drill pipe also permits any cement in excess of that required for the job to be passed back inside the casing during the cementing operations without harmful effects since the tubing or drill pipe can be pulled up or taken entirely out of the well when all the cement necessary has passed through the retainer.

The cement retainer used on the following applications is run to a point just above that in the casing or liner where the cement is to be forced out. It is equipped with a short packer rubber, which is expanded and set at the same time that slips are set to prevent the entire device from moving. Cement pumped down the tubing or drill pipe passes through the retainer, but is prevented from passing back up by a back-pressure valve. When the cementing job is completed, the tubing or drill pipe connected to the retainer by left-hand square threads, is unscrewed and pulled up. The cement is thus retained in place without disturbance from any action that takes place above the valve.

It is the general custom to use with the cement retainer a circulation jar, which is run immediately above the retainer itself but which is removed with the tubing. Being a combined jar and valve, its most valuable function is probably to bleed circulating fluid preceding the cement from the tubing. Mud and water need not, therefore, be pumped into the formation ahead of the cement.

A later development in equipment for recementing and repair work is the casing bridge plug, which is frequently used in connection with the cement retainer. This device is placed at any desired depth in the casing to keep the cement from going below that point. It is prevented by two sets of slips from moving either up or down after it has been set. Both the cement retainer and the bridge plug are similar in operation and construction and, being made of cast iron, are readily drilled up when the cementing job is completed.

### Recementing

In cementing a wet original cementing point with a cement retainer when no circulation is available, the retainer can be set just above the shoe and cement under pressure forced into the openings that are admitting the water. Circulation, however, can frequently be obtained through perforations made above the old job. In a case of this kind, the cement retainer is set just above these perforations and the cement forced out through them to behind the casing. Squeeze jobs that cannot be done around the shoe can sometimes be accomplished in this way also. In any case, the cement is kept under pressure and prevented from coming back into the casing by the back-pressure valve in the cement retainer.

In recementing a combination string, a little more difficulty is offered to other methods when the cement point of the section serving as the water string proves wet. The cement retainer, used in connection with the casing bridge plug, will often provide an easy solution as in the case illustrated in Fig. 1. The bridge plug was here used to save the expense of plugging back with cement.

This job was in a deep well at Ventura, California, where a 7-in. O.D. combination liner had to be recemented due to water leaking around the cementing point. A casing bridge plug was placed at 7294 ft.—just above the original cement point. The pipe was then perforated at 7288 ft. and a 7-in. cement retainer run on 2½-in. upset tubing to 7280 ft., where it was set. Fifty sacks of cement were introduced but only 25 sacks could be forced behind the casing under a pressure of 2150 pounds. The excess cement was pumped from the tubing by means of the valve in the circulation jar before it was unscrewed from the retainer. The tubing was raised out of the liner and, as a precautionary measure, was packed off at the top and left in the hole, hanging above the liner, with a pressure of 1200 lb. applied to it.

In another case, Fig. 2, a 5-in. combination liner supported in 8⅝-in. casing with its top at 3721 ft. was recemented without the use of a casing bridge plug. This was a well in Long Beach in which the liner was filled, inside and out, with sand from its bottom at 4942 to 4603 feet. A cement retainer was set at 4560 ft. and 24 sacks of cement were pumped in under 1500 lb. pressure. Any excess cement that might have been left in the tubing was removed after the tubing had been unscrewed from the retainer.

The adaptability of the cement retainer—usually with the casing bridge plug to confine the movement of the cement down the pipe—is evident where high pressure, utilization of localized circulation, and the necessity for keeping the pressure on the cement are all factors at points anywhere up the casing or liner.

In one well in Kettleman Hills a bridge plug alone was used to recement through a cementing collar. It was believed that water was coming through the cementing collar and through perforations below it in a string of 6⅝-in. casing. The bridge plug was set in the casing at 8358 ft., 50 ft. below the cementing collar. A squeeze job was then used, forcing the cement out through the perforations above the plug and through the openings in the cementing collar. The perforated pipe left below the plug extended to 8600 ft., or a length of 242 feet.

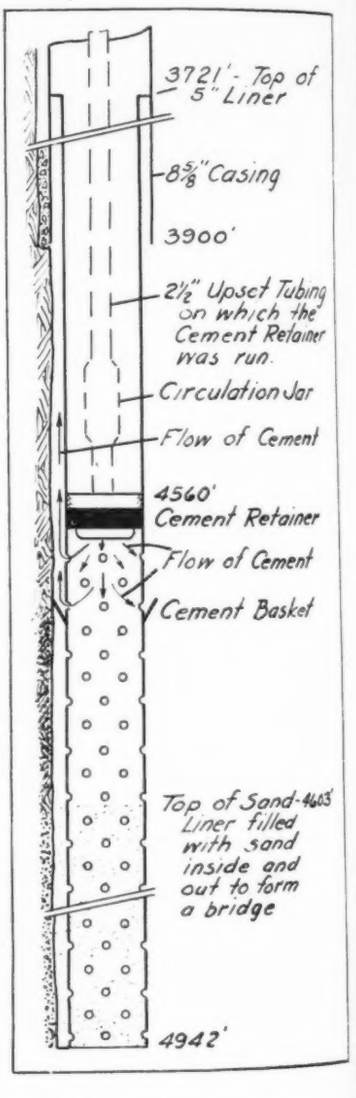

3721'- Top of 5" Liner
8⅝" Casing
3900'
2½" Upset Tubing on which the Cement Retainer was run.
Circulation Jar
Flow of Cement
4560' Cement Retainer
Flow of Cement
Cement Basket
Top of Sand-4603' Liner filled with sand inside and out to form a bridge
4942'

**Fig. 2. Recementing through upper perforations with sand plug built up from bottom**

### Plugging

While the shutting-off of a lower water-bearing sand in plugging-back operations is frequently a simple operation, there are cases where the cement retainer is particularly

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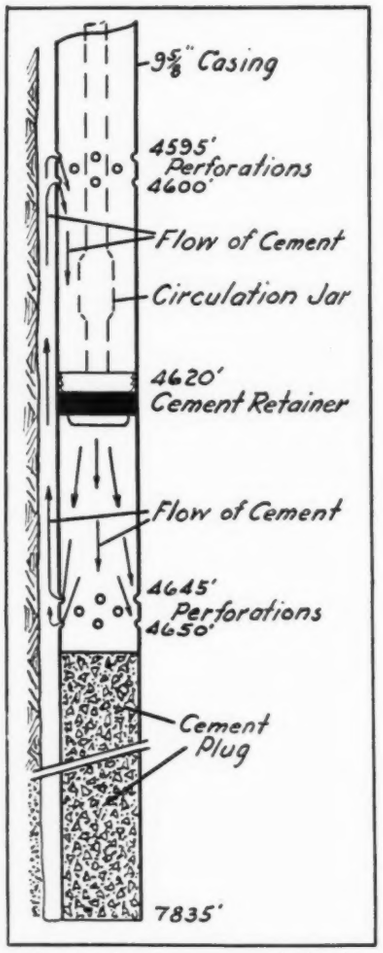



**Fig. 3. Putting cement behind casing in plugging back**

adaptable. In one well in the Long Beach field, a cement retainer with a 5-ft. rubber packer was used to give a better bond between perforated casing and the wall of the hole. The casing was 6⅝-in. perforated and was landed at 4780 feet. A plug, made by pumping cement through the drill pipe, was built up to 4333 ft. and a special 5-ft. cement retainer then set at 4329 ft. on 2½-in. drill pipe. Circulation was obtained with 100 cu. ft. of water and broke through at 250-lb. pressure. The pressure then fell to zero and sufficient cement was pumped in to extend about 100 ft. above the retainer. Since the pipe cemented was perforated, the long cement retainer insured a bond between it and the wall at the most vital point—just above the plug.

Plugging back to an upper zone may sometimes present problems that can only be determined by a study of the casing record of the well. In the Santa Fe Springs field, a number of the wells have been plugged back to the Myer zone and one method used is shown in Fig. 3.

The 9⅝-in. casing was bottomed at 7835 feet. A cement plug was put in the bottom but to insure that water below the new producing zone was shut off, the pipe was cemented both inside and out above the plug. To do this, perforations were made from 4650 to 4645 ft. and from 4600 to 4595 ft. and a cement retainer set at 4620 feet. Twenty-nine sacks of cement were then pumped in under a pressure of 750 lb., the cement passing out the pipe through the perforations at 4650-4645 ft. and back on through the perforations at 4600-4595 feet.

During the plugging back of a well in the Dominguez field, some interesting tests were made on the operation of a cement retainer. In this well, it was desired to make sure that cement was forced behind 90 ft. of 9-in. blank pipe between perforations. As shown in Fig. 4, the cement retainer was set in the pipe just above the lower perforation.

Circulation was established through the cement retainer, out the lower perforations, behind the pipe, in through the upper perforations, and out the casinghead at the top. The pressure necessary for this was 1000 lb. but to make sure the fluid was actually going behind the casing instead of by-passing the cement retainer, the valve in the circulation jar was opened. The volume of fluid suddenly increased and the pump pressure dropped to 300 pounds. The valve was then closed again, the volume dropped, and the pressure returned to 1000 pounds.

Thirty-five sacks of cement were then pumped down the tubing with the valve in the circulation jar open until just before the cement reached the retainer. The valve was then closed and the cement pumped behind the blank casing.

The valve in the circulation jar was again opened and 65 sacks of cement pumped out through it on top of the retainer. The tubing was then unscrewed and pulled out.

## Repair Work

So many conditions influence repair work that each job is usually a specific problem that must be treated individually. Use of a cement retainer, with or without a casing bridge plug, cannot be blindly recommended. Wherever free circulation is not available, however, the chances are that this device can be used with advantage. Where casing is bad, where leaks are permitting water to enter, and where water is coming through the perforations—these are conditions that frequently arise and are of a more or less general nature.

In a well at Baldwin Hills, California, it was desired to plug below some bad 12½-in. casing on which pressure could not be safely applied. The string was landed at 1640 ft. and the cement was to be forced up around it to 1631 feet. A cement retainer was, therefore, run to 1630 ft. on 2½-in. tubing and the cement placed without putting any pressure on the bad pipe above that point. By using a cement retainer and bridge plug, all pressure can be confined to any desired section of bad pipe when it has to be repaired with cement.

Sometimes in repairing leaky casing or shutting off water coming through perforations, the casing bridge plug can be used alone and the cement forced under pressure into the openings to get behind the pipe. It must be remembered, however, that when pressure has to be left on the cement after it reaches position, reliance must be placed on surface connections unless a cement retainer with its back-pressure valve or some similar device is used.

The bridge plug is also of value in verifying water intrusion data. In most cases where it has been used for this purpose it is left in the hole after checking up the water entry and utilized for cementing off the water.

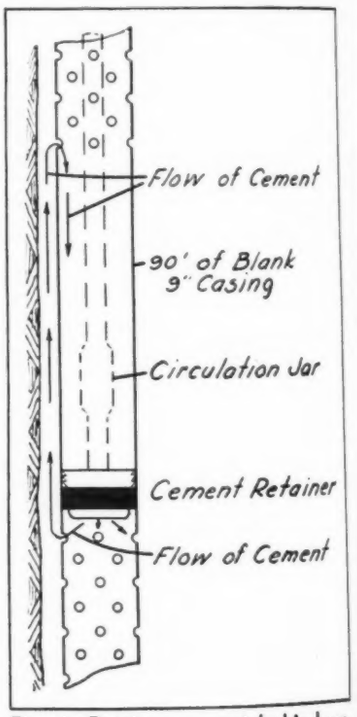
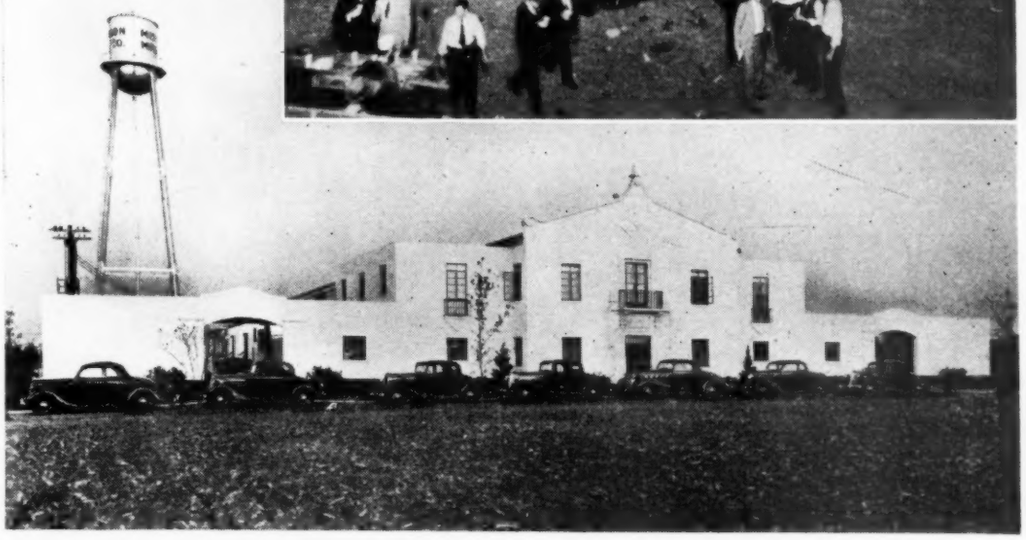



**Fig. 4. Putting cement behind section of blank pipe in a perforated string in plugging back**

# Oil Men Elaborately Entertained at Opening of New Mission Plant

*Below—View of the new Mission Manufacturing Co. plant showing a number of cars used by Mission representatives in serving the trade in the Gulf Coast area.*

*Right—The boxing ring at the time the announcer was calling the crowd away from the eats to be seated to enjoy the fights.*



THOUSANDS of oil men enjoyed elaborate entertainment marking the opening of the Mission Manufacturing Company's new $100,000 plant on April 13 at Houston, Texas.

Guests from the Gulf Coast and Mid-Continent were shown through the offices and plant and were then treated with an appetizing barbecue and refreshments on tables that surrounded a boxing ring. Naturally, the crowd expected to see boxing matches when they saw the well-staged prize fighting paraphernalia but their expectations were more than realized when they viewed a program of excellent bouts comparable with highest class professional engagements. The climax of the fighting was a ten-round bout between Wildcat Monte and Salvadore, two headline fighters whom promoters have never before been able to match. It remained for the officials of the Mission Manufacturing Co. to bring together these two fisticuff kings whose exhibition was worthy of their respective reputations as fighters.

The oil men on leaving were unanimous in saying to officials of the company, Bedford Sharp, Dudley Sharp and W. T. Campbell, that they had never enjoyed an opening event that moved more smoothly, more entertainingly and more dramatically.

## Underwood Nazro Passes Away

Underwood Nazro, Houston, Texas, executive vice-president of the Gulf Production Company and the Gulf Pipe Line Company, died at his home April 21.

Nazro was born at Bowling Green, Kentucky, 60 years ago. He was widely known throughout the petroleum industry, having been identified with Texas' oil history since the early days at Spindletop. At the time of his death he was considered one of the industry's leaders.

Surviving relatives are his widow; a daughter, Mrs. Joseph Mullin; and a son, Wheeler Nazro.

## Philadelphia Office Republic Steel to New Address

Effective May 18, the Philadelphia District sales office of Republic Steel Corporation, and subsidiaries, Berger Manufacturing Company, and Union Drawn Steel Company, will be removed from the Fidelity-Philadelphia Trust Building, to the Broad Street Station Building, 1617 Pennsylvania Boulevard, according to an announcement by N. J. Clarke, vice-president in charge of sales for Republic.

J. B. DeWolf continues in charge of the office as district sales manager, assisted by the present staff. DeWolf has notified the trade that the office will be closed all day on May 18 to permit the work of removal.

## Death of Clyde M. Bennett Shock to His Many Friends

The many friends of Clyde M. Bennett, vice-president and assistant manager of production for the Magnolia Petroleum Company, were greatly grieved to hear of his death at his home in Dallas, Texas, on April 25.

A native of Walkersville, W. Va., Bennett was a graduate of West Virginia University. He was geologist for the Philadelphia Company, Pittsburgh, from 1900 until 1913. From 1913 to 1915 he was with the Benedum-Trees Company of Pittsburgh. He worked with the Arkansas Natural Gas Company at Shreveport for a time and in 1919 he became vice-president and director of the Louisiana Oil & Refining Corporation. In 1926 he became president of the Trinidad Oil Fields Operating Company.

Bennett went with the Vacuum Oil Company of New York as general manager of the crude oil department in 1928, with headquarters in New York and Houston. Since 1931 he had been with the Magnolia Petroleum Company.

He was the first president of the Arkansas-Louisiana division of the Mid-Continent Oil & Gas Association, and was instrumental in its organization.

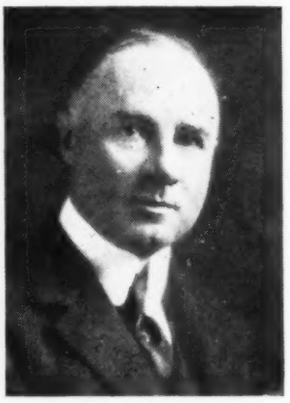
Funeral services were conducted at Dallas with interment at Shreveport, Louisiana.

Surviving are his widow, three sons, Carol, Kenneth and Donald Bennett; a daughter, Martha Bennett; and his parents, Mr. and Mrs. Hanson Bennett, all of Dallas.

## Westinghouse Elects New Director

A. W. Robertson, chairman of the board of the Westinghouse Electric and Manufacturing Company, has announced that, at the annual meeting of stockholders of the company, Winthrop W. Aldrich, H. B. Rust, and Samuel M. Vauclain were re-elected members of the board of directors.

The election of John L. Hall, senior member of the law firm, Choate, Hall & Stewart, of Boston, as a director of the company also was announced.



JOHN L. HALL

## Ernest A. Hanson Transferred

Ernest A. Hanson, deputy supervisor of the Mid-Continent District, Oil and Gas Leasing Division, U. S. Geological Survey, has been transferred from the Tulsa, Oklahoma, office to the office at Roswell, New Mexico.

## M. G. McCool Now With American Iron and Machine Works Co.

M. G. McCool, who is well known because of his many years experience in oil field supply business, is now representing American Iron and Machine Works Company, of Oklahoma City, Oklahoma. John Riley, sales manager for American Iron and Machine Works Company, at present is on a trip with McCool through West Texas and New Mexico. Midland, Texas, is their headquarters for this territory. McCool was formerly with Oil Well Supply Company.

## New Warehouse Distributor for Enduro Stainless Steel

A recent addition to the list of warehouse distributors of Enduro stainless steel is the Gilmore Steel and Supply Company, 825 Folsom Street, San Francisco, California, according to an announcement by N. J. Clarke, vice-president in charge of sales for Republic Steel Corporation, Youngstown, Ohio.

With the appointment of the Gilmore Steel and Supply Company, there are now available 45 warehouse stocks of Enduro stainless steel in principal cities from coast to coast.

## J. E. Holveck Joins Worthington

Worthington Pump and Machinery Corporation, Harrison, New Jersey, announces the appointment of J. E. Holveck as special sales engineer, operating from its Pittsburgh office but extending his activities also to the territories of the Cleveland, Detroit, Chicago, and Buffalo offices. Holveck formerly was a member of the engineering staff of Worthington's Holyoke Works and later was associated with The Aldrich Pump Company as sales engineer in its Pittsburgh and middle west districts.

## San Joaquin Valley A. P. I. Meeting

The next meeting of the San Joaquin Valley Chapter of the A. P. I. will be held May 21st at the Standard Oil Company Recreation Hall in Taft, California.

## Kansas Chapter A.P.I. Met at Great Bend

The Kansas Chapter of the A.P.I. held its monthly meeting at Great Bend May 10. D. A. Jordan of the Atlantic Oil Company presented a paper on "Drilling and Production Practices in Western Kansas," which was followed by a general discussion. W. G. Lane of the Lane-Wells Company gave a talk on "Casing Perforators," the talk being accompanied by a motion picture on the subject.

## Los Angeles Basin Chapter A. P. I. Met May 7

At the meeting in Long Beach, California, on May 7th, of the Los Angeles Basin Chapter of the A.P.I. Division of Production, Rush M. Blodget, general manager of the Oil Producers Agency, spoke on the "Possible Effects on the Oil Industry of Proposed State and National Legislation."

A talk on the "Development of the Multiple-Cylinder Gas Engine in Oilfield Practice," was given by A. K. Hegeman of Smith-Booth-Usher Company.

Time was given for open discussion and questions following each talk.

## Special Librarians' Convention

The Special Libraries Association will hold its twenty-seventh annual convention in Boston, June 11 to 14, with headquarters at the Hotel Statler. This organization now has a membership of over 1600 trained librarians who manage the libraries of industrial concerns, research laboratories, banks, business offices, newspapers, museums, law, medical, scientific, and other societies, as well as the specialized departments in large public, college and university libraries—in fact, any library devoted to one special field. The importance of trained library service to such special groups is now widely recognized and the Special Libraries Association devotes itself actively to the improvement of the methods and quality of such service.

The program of the coming meeting includes visits to the special libraries of Harvard University, Massachusetts Institute of Technology, and other special libraries in the Boston area, besides three general sessions and a large number of group and section meetings. The Science-Technology Group, which, with a membership of over 200, is one of the most active, will hold three meetings. There also will be opportunity for visits to historic shrines in and near Boston.

Within the Science-Technology Group are some 22 librarians in research departments of petroleum companies from New York to Texas and California, who have formed a petroleum section, with Albert A. Althoff, of the General Petroleum Company of California, Los Angeles, as chairman.

## Engineering Societies to Hold Joint Meeting May 20

Officers and directors of the national societies of civil, mining and metallurgical, mechanical, and electrical engineers, and of their several jointly sponsored functional organizations will meet together for dinner Monday, May 20, at the Engineers' Club in New York, according to plans recently announced by United Engineering Trustees, Inc., acting for the societies in sponsoring the proposed meeting. This is the first time in the history of the engineering societies that any such meeting has been undertaken and it is considered to be an important and significant step toward the establishment of a broader and clearer understanding of the scope and significance of the work carried on jointly by the several participating societies.

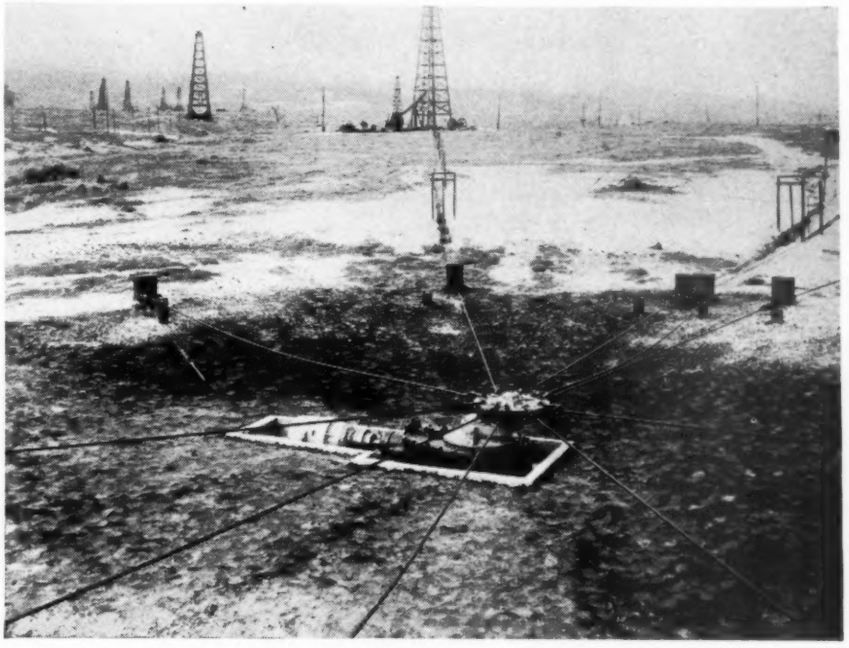
# Elements of Applied Petroleum Production

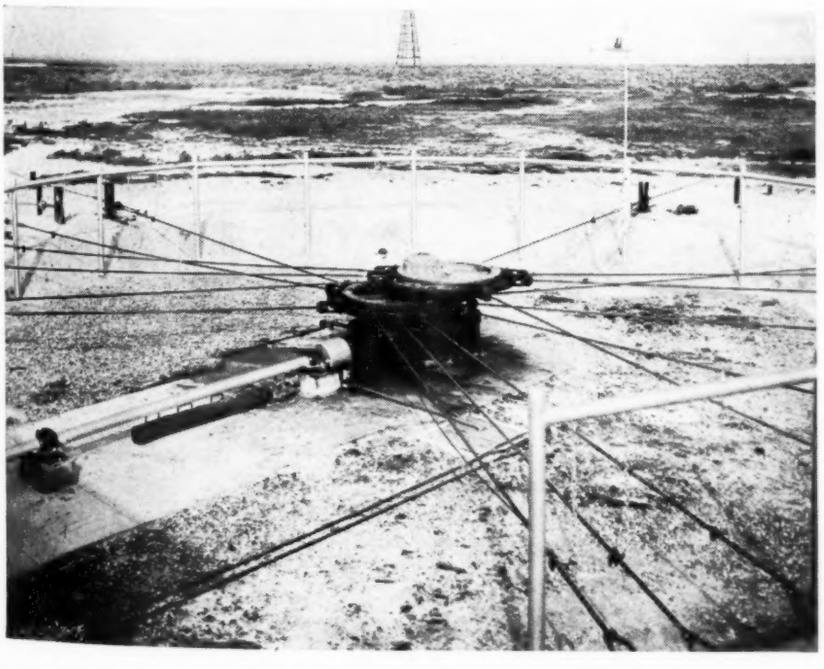
By K. C. SCLATER

Article 19

## CENTRAL PUMPING POWERS (Continued)

MODERN central pumping powers are adapted to operate under a wide variety of conditions. The photographs on this and the following page are of recent field installations of modern geared central pumping powers. It may be surmised from this group of pictures that surface conditions alone seldom are such as to preclude the installation of a central pumping power.



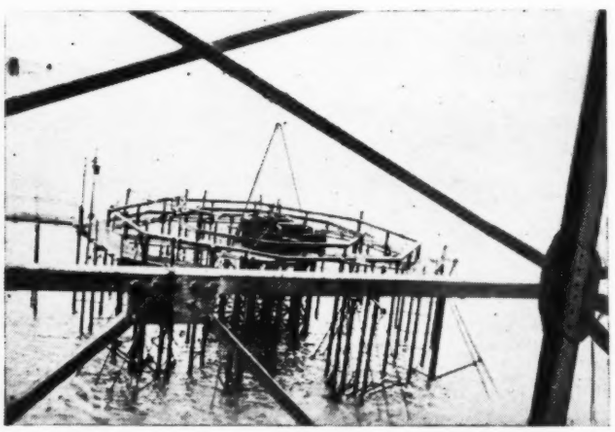


Above: This central pumping power, consisting of an "Oilwell" No. 30-SC oilbath geared power direct-coupled to a U. S. Synchrogear motor, is on the lease of a major company near Taft, California. Ten wells, 1800 ft. deep are connected to the power. It should be observed that with this compact type of installation there is no blind angle to consider so far as the power itself is concerned. The prime mover and its housing are below the plane of the crank disk, thereby permitting the rod lines to be led off at any desired angle.

Left: This central pumping power, which is an "Oilwell' No. 50 oilbath geared power driven by a gas engine and V-belt drive to high-speed shaft extension, is on a lease near Taft, California. As will be observed, 15 wells (six on the upper eccentric and nine on the lower eccentric) are hooked up to the power. The wells are 1800 ft. deep.

This installation, an "Oilwell" No. 30-SC oilbath geared power driven by electric motor, is on a hillside location in Pennsylvania. The surface conditions shown here are typical of those commonly encountered in the fields of Pennsylvania, where central pumping powers are widely used.

Even water locations do not preclude the employment of a central pumping power. Here are several views of an "Oilwell" No. 80 (double eccentric type) oilbath geared power installed over the ocean on a shoal at Comodoro Rivadavia, Argentina, South America.



View of the central power taken from the derrick of one of the wells being pumped. Note that the power is set on piling.

The power is driven by electric motor, which is housed in the fan-shaped steel sheet cover seen in the foreground.

Here is shown the detail of the right-angle brackets at the top of the platform of the central power for rod-line take-off connections.

# Elements of Applied Petroleum Refining

By W. L. NELSON
Consultant*

Article XIX

## HEATING AND HEAT LOSSES—(Continued)

### HEAT TRANSFER EQUIPMENT

TWO general types of heat transfer equipment are widely used—coil-in-box equipment and tubular equipment. The tubular equipment may be classified as heat exchangers, vapor heat exchangers, condenser exchangers, and tubular coolers. If the two materials that exchange heat are liquids, the equipment is referred to as an exchanger, unless the cooling agent is water, in which case it is referred to as a cooler or after-cooler. If the hot material is a vapor and it is cooled without much condensation, the equipment is called a vapor heat exchanger; whereas if it is condensed then the equipment is called a condenser exchanger.

The same operations may be conducted in so-called coil-in-box equipment, but the present trend is to use tubular equipment for all operations except the final cooling with water. Theoretically, tubular equipment gives higher transfer rates and is cheaper, but if dirt is deposited from the stocks, if the water is hard or brackish, or if any serious fouling condition exists, then tubular equipment is not satisfactory. The factors that usually make the heat transfer rate greater in tubular equipment are made ineffective by severe fouling conditions so that the advantages of the tubular equipment are lost and the coil-in-box equipment is equally satisfactory and at the same time cheaper; in other words, the effectiveness of tubular equipment is dependent upon clean surfaces so that tubular equipment must be used for clean conditions or it must be periodically cleaned.

In the past, exchangers were built with many passes on the tube side but the present trend is to limit the number of passes to a maximum of six on the tube side. If a large number of passes are used, counter-current flow is not attained and the heat that is transferred is decreased so greatly that it overshadows the advantage of the increased velocity that can be obtained by a large number of passes. On the shell side, the number of passes seldom exceeds two. It is becoming increasingly common practice to use several units of exchanger with only two passes on the tube side (one on the shell) instead of a single unit with many passes on the tube side. There are several important advantages to the use of several units of exchanger rather than one large exchanger. Among these advantages are: (1) counter-current flow is more nearly attained; (2) cleaning operations are facilitated because one unit at a time can be removed from the system without seriously interrupting the operation—the same applies to a leaky tube, etc.; and (3), small tube bundles and exchangers are more easily handled.

Baffles are used on the shell side to produce turbulence in the liquid. Three common types are used: (1) the cross-flow type, an example of which is an arrangement of alternate circular and annular ports; (2) the orifice type in which the holes in the baffle, for the tubes, are oversize so that the fluid must scour the tube wall as it passes through the baffle; and (3), the spiral-flow type, which imparts a spiral flow to the fluid. Theoretically, the more baffles the greater the transfer rate but the use of a large number of baffles is usually impossible because the pressure drop through the shell-side is prohibitive. In fact, the design of an exchanger depends to a large extent on two variables—the transfer rate and the pressure drop. The transfer rate (velocity) should be increased as much as possible without exceeding the allowable pressure drop.

Shells and heads are usually constructed of cast iron, although forged and welded steel must be used for high-temperature and high-pressure conditions. The tubes are usually of steel or admiralty metal (brass) but special materials may be used for corrosive conditions. Rather large tubes, ¾ in. and 1 in. in diameter, are now used almost universally.

**FOULING FACTORS.** The film transfer coefficients that were discussed in previous articles (Articles XVII and XVIII, *The Petroleum Engineer*, March and April, 1935) cannot be used directly in the design of commercial equipment. Deposits always accumulate on the heat transfer surfaces and the theoretical coefficient of heat transfer is greatly reduced thereby. Transfer rates for carefully cleaned surfaces often amount to more than 1000, but upon standing overnight in liquid, the rate may drop to 800 and after being used for two weeks it may be as low as 50. Thus, the fouling conditions are at least equally as important as the film coefficients.

The general extent[1] of the fouling resistance is indicated by Table 23.

**TABLE 23**
**Fouling Factors**

| Resistance by Fouling | Fouling Factor | Equivalent Transfer Rates | Condition of Surface |
|---|---|---|---|
| .0005 and less | .5 | 2000 and more | —— |
| .001 | 1. | 1000 | Commercially clean |
| .002 | 2. | 500 | Slight dirt film |
| .01 | 10. | 100 | Normal dirt film |
| .02 | 20. | 50 | Severe corrosion or scale |
| .05 | 50. | 20 | Wax or hard coke |

The resistance due to fouling is usually so small that it is confusing and hence the use of the term fouling factor, which is 1000 times the resistance, is becoming common.

As an example of the effect of the fouling resistance on the overall coefficient of heat transfer for an equipment that has been cleaned with chemicals, etc., consider a commercial exchanger for cooling kerosene with crude oil. If the surfaces were chemically cleaned, the overall transfer rate, for normal velocities, would be about 150. After the first moment of service the rate drops about as shown in Table 24.

*Professor of Petroleum Refining, University of Tulsa.

**TABLE 24**
**Effect of Surface Condition**

| Condition | Fouling Factor | Overall Transfer Rate | |
|---|---|---|---|
| Chemically clean | — | 150 | |
| After one day | 2 | 100 | |
| After 10 days | 10 | 50 | Normal dirt film |
| After 90 days | 20 | 33 3 | Without periodic cleaning except at shut-downs |
| Commercially cleaned | 3 | 91 | Immediately after cleaning |
| Blown with steam daily | 13 | 47 | Not always successful |
| With corrosion, etc. | 25–50 | 30–17 | On a dirty crude oil |

**OVERALL TRANSFER RATES.** There is no way to correlate satisfactorily overall transfer rates because all the factors such as, fouling condition, kind of oil, velocity, temperature, etc., cannot be taken into account in one correlation. The unsatisfactory results with overall rates that may be found in handbooks, etc., is ample proof of the above. Nevertheless, overall commercial transfer rates are useful for the simplest sort of estimates and as a means of comparing conditions. If a plant man has no time to study transfer rates in a serious way, then overall rates can be of some service.

The overall rates that can be expected in tubular equipment are given in Table 25. These coefficients are for normal conditions of temperature and velocity and for normally clean stocks. The very variety of conditions alluded to above

**TABLE 25**
**Approximate Overall Transfer Rates in Tubular Equipment**

| | Material Fluid A | Cooling Agent Fluid B | Equipment | H | Pumped* (Fluid A) |
|---|---|---|---|---|---|
| 1. | Gasoline | Crude | Condenser | 37 | No |
| 2. | " | Water | Condenser | 48 | No |
| 3. | " | Water | Cooler | 47 | No |
| 4. | Kerosene | Crude | Exchanger | 25 | No |
| 5. | " | Water | Cooler | 31 | No |
| 6. | Gas oil | Crude | Exchanger | 33 | No |
| 7. | " " | Water | Cooler | 24 | No |
| 8. | Wax distillate | Crude | Exchanger | 27 | No |
| 9. | " " | Water | Cooler | 14 | No |
| 10. | Reduced crude oil | Crude | Exchanger | 32 | Yes |
| 11. | " " " | Crude | Exchanger | 14 | No |
| 12. | Residuum | Crude | Exchanger | 15 | Yes |

*Crude oil and water are always pumped.

makes any list of rates such as those given in Table 25 of limited value.

The overall rates for coil-in-box equipment are even lower than for tubular equipment. The rates are low for several reasons. Most important among these is the fact that dirt and rust always accumulate in the boxes and cleaning is a difficult operation. In addition, the velocities through the pipe must be low in order to avoid a prohibitive pressure drop. The condition of the surfaces is such an uncertain one that no definite rates for coil-in-box equipment can be given but they are always low. Table 26 indicates the general magnitude of the overall coefficients for normal conditions.

**TABLE 26**
**Approximate Overall Transfer Rates for Coil-in-Box Equipment***

| Material | Operation | H |
|---|---|---|
| 1. Gasoline or naphtha | Condensing and cooling | 18 |
| 2. Gas oil | Condensing | 24 |
| 3. Gasoline or naphtha | Cooling | 18 |
| 4. Kerosene or gas oil | Cooling | 16 |
| 5. Wax distillate | Cooling | 12 |
| 6. Lubricating oils | Cooling | 14 |
| 7. Tars, residuums, etc. | Cooling | 10 |

*Cooled with water.

**MISCELLANEOUS CONDITIONS.** In the transfer of heat through a gas film, the film coefficient for the gas is usually so low, that is the resistance is so great, that dirt on the surface has little or no effect. At high gas velocities the dirtiness of the surface does become important, but in such common cases as (1) heat transfer in a convection section of a still, or (2) heat transfer by natural convection from an uninsulated surface, the velocity is low and dirt has little effect.

Wax-containing stocks also give particularly low rates. Wax will sometimes be deposited in the film even though the main fluid temperature is far above the solidifying temperature of wax. Wax collects at the surface because the temperature in the film is much lower than the main fluid temperature. If the wax-containing stock must be chilled to solidification temperatures, then special scraper devices must be employed.

Coke is deposited at the walls of heated equipment because the temperature in the film is much higher than in the main body of fluid and at the same time the material that composes the film, remains at the surface for a relatively long time. Thus, coke may be deposited inside of tubes or on the bottom plates of a still even though the main body of fluid does not reach a temperature that would cause cracking. Much the same phenomenon occurs in water films. Scale-forming constituents are not deposited from water until temperatures exceeding 170 deg. fahr. are attained; however, a tendency to produce water-scale appears in heat transfer equipment as soon as a water temperature of 125 deg. fahr. is attained. This phenomenon is also due to the much higher temperature that exists in the water film and near the heated surface.

**TABLE 27**
**Approximate Overall Transfer Rates for Miscellaneous Equipment**

| | Equipment | Operation | H | Notes |
|---|---|---|---|---|
| 1. | Shell still | Boiling liquid | 6–10 | No circulation |
| 2. | " " | " " | 10–14 | Forced circulation |
| 3. | Coke still | Pressure coking | 4–6 | — |
| 4. | Uninsulated equip. | Heat loss to air | 2 | Vertical or slanting surfaces |
| 5. | Screw chillers | Freezing wax | 4 | Brine circulation |
| 6. | " " | " " | 8 | Direct expansion of ammonia |
| 7. | Ribbon chillers | " " | 10 | Direct expansion of ammonia |
| 8. | Pipe still | Convection section | 7 | Combined convection and radiation |
| 9. | Vacuum condenser | Condense wax dist. | 12 | In presence of steam (40 mm.) |
| 10. | " " | Condense steam | 9 | At about 40 mm. |

Table 27 shows overall rates for some less-common operations.

## QUESTIONS

1. What are some of the advantages of using several units of exchanger rather than one large exchanger?
2. Is tubular equipment always cheaper than coil-in-box equipment?
3. Under what conditions is coil-in-box equipment to be preferred to tubular equipment?
4. Why are coke and water-scale deposited at the surface rather than in the liquid?

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[2] "American Petroleum Refining," by Bell, D. Van Nostrand Co. (1930).

[3] "Heat Exchangers," Bulletin No. 350, Ross Heater and Manufacturing Co. (1931).

[4] *The Petroleum Engineer*, by Coulthurst & Scoville, page 76, April, 1931, and page 101, May, 1931.

# AMERICAN

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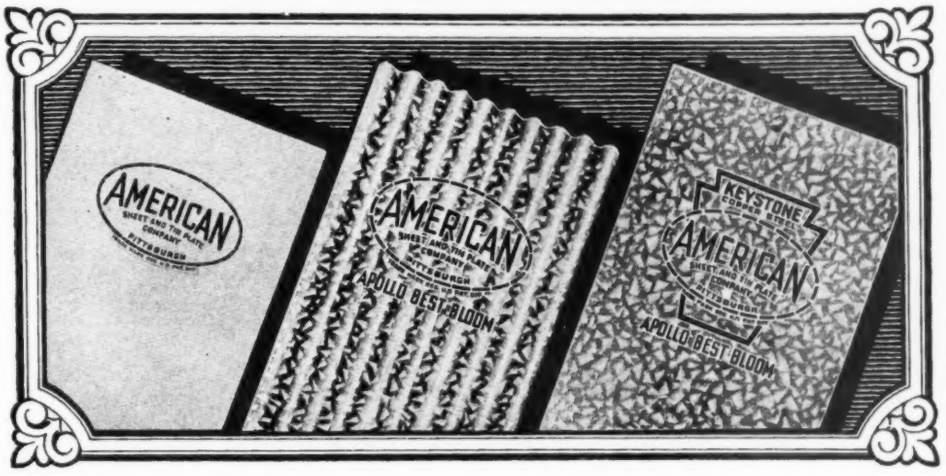


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AMERICAN products have demonstrated their adaptability for oil field and construction uses—and their wide utilization is evidence of the tremendous progress made in steel sheet and tin plate manufacture. Supplied in Black and Galvanized Sheets, Formed Roofing and Siding Products, Tank, Flume and Culvert Sheets, Tin and Terne Plates.

USS Stainless Steel Sheets

Inquiries regarding any application of USS STAINLESS and Heat Resisting Steel Sheets or Light Plates, or any product fabricated from these alloy materials, will be given prompt and careful attention.

*Specify* AMERICAN *Products, which have an established reputation for quality and service*
*— Manufactured by —*

## American Sheet and Tin Plate Company

**GENERAL OFFICES: Frick Building, PITTSBURGH, PA.**

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*United States Steel Corporation Subsidiaries*

# Elements of Applied Petroleum Pipe Line Transportation

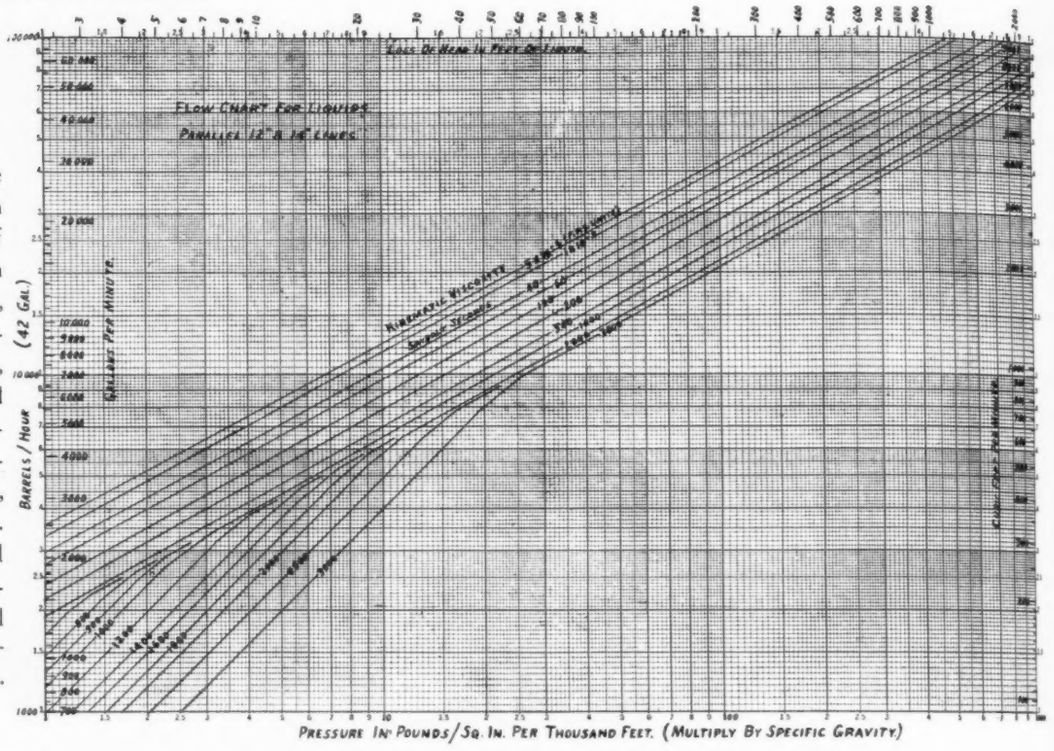
Article 10

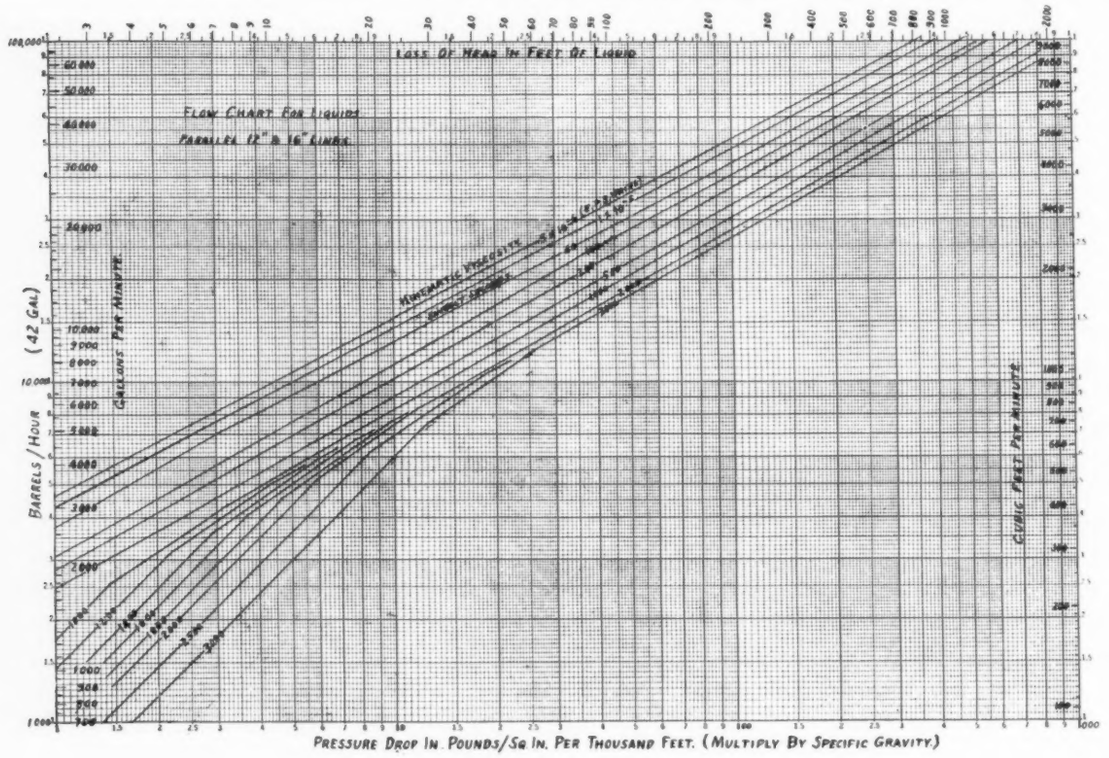
## THE FLOW OF OIL IN PIPES AND PIPE LINES

By EMORY KEMLER
and L. L. THOMAS

### Flow Charts

SIX charts are given this month for the solution of flow problems in pipes and pipe lines, namely: Parallel 12-in. and 14-in. lines, parallel 12-in. and 16-in. lines, combination 4-in. and 8-in. parallel lines, combination 6-in. and 8-in. parallel lines, combination 6-in. and 10-in. parallel lines, and combination 6-in. and 12-in. parallel lines.


Loss Of Head In Feet Of Liquid
Flow Chart For Liquids
Parallel 12" & 16" Lines
Barrels / Hour (42 Gal.)
Gallons Per Minute
Cubic Feet Per Minute
Pressure In Pounds/Sq. In. Per Thousand Feet. (Multiply By Specific Gravity)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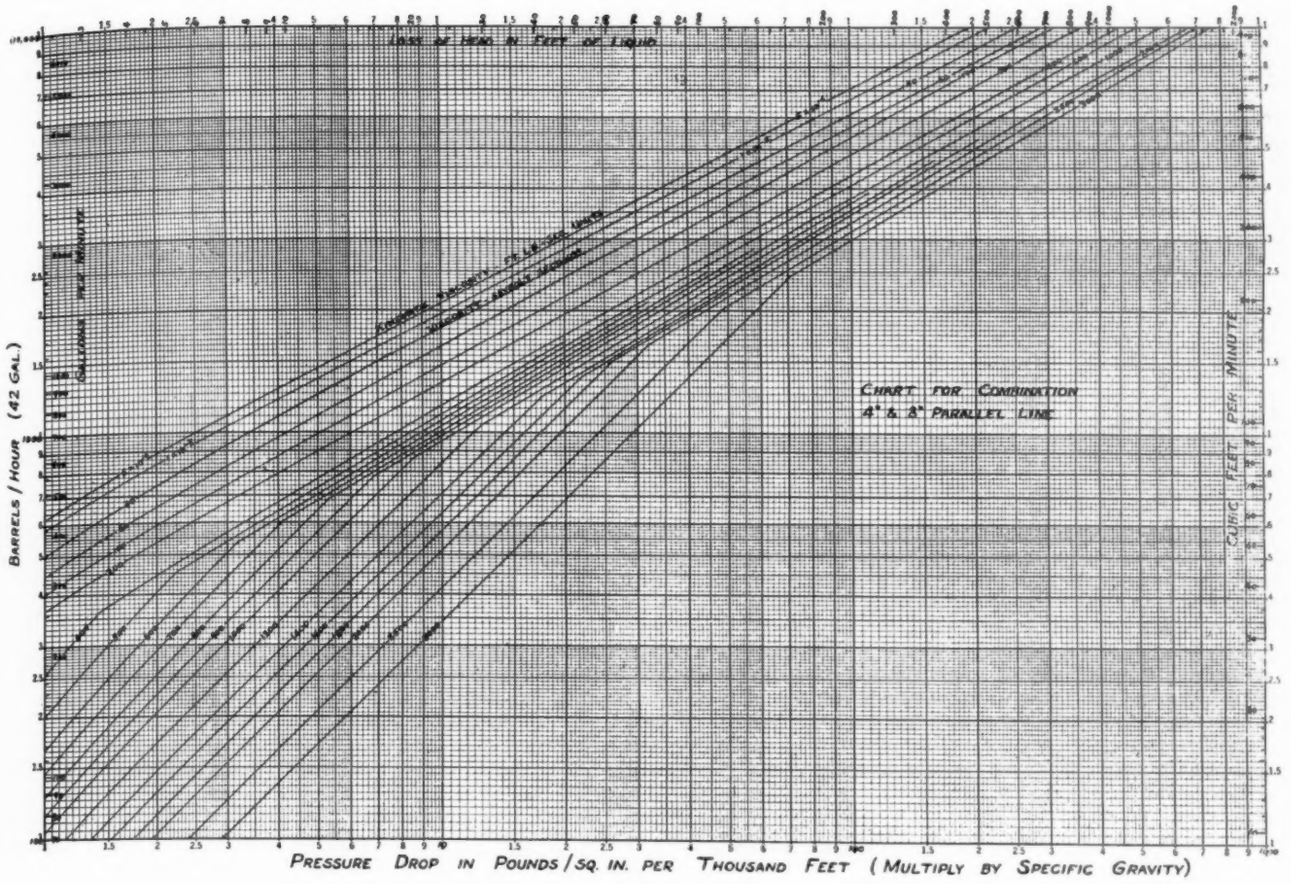
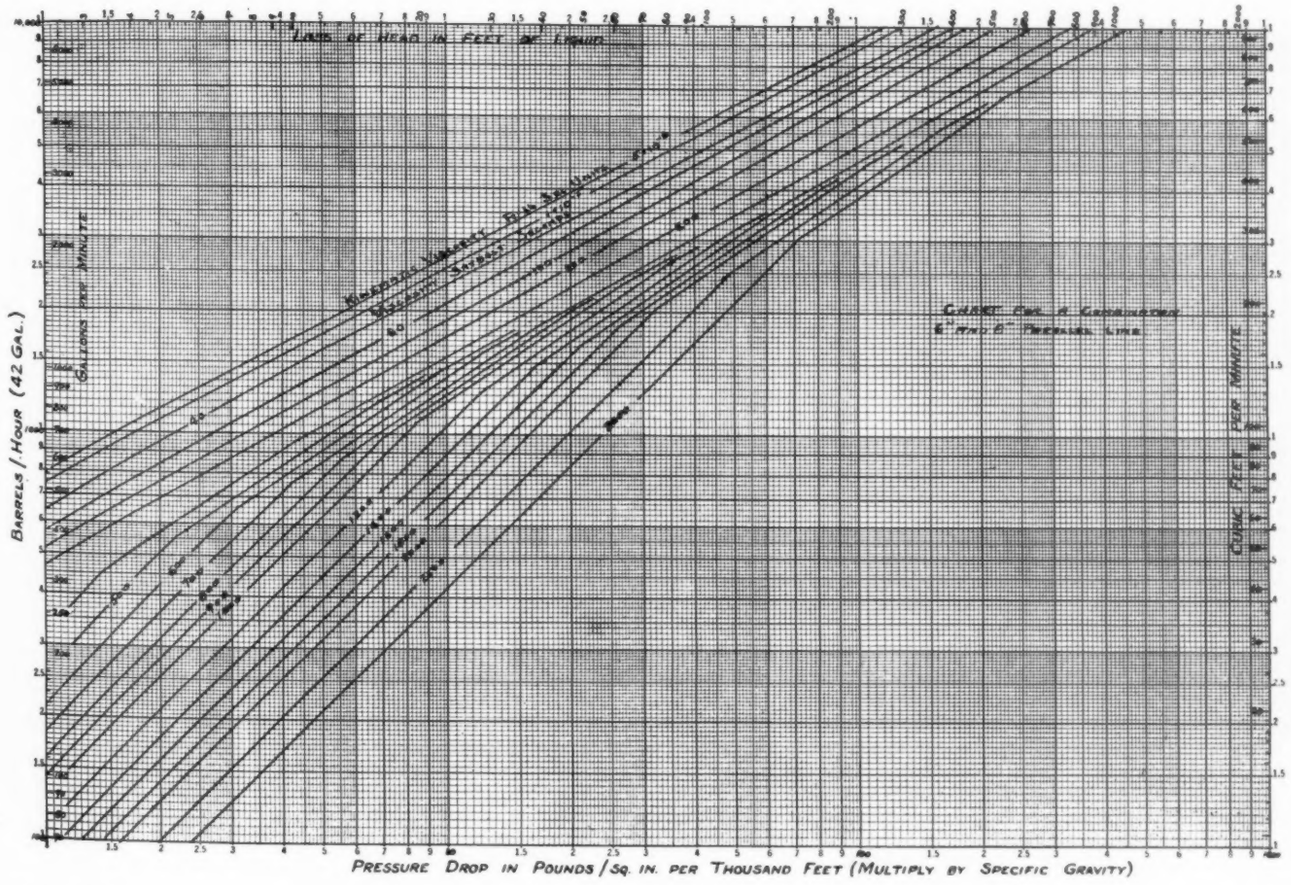
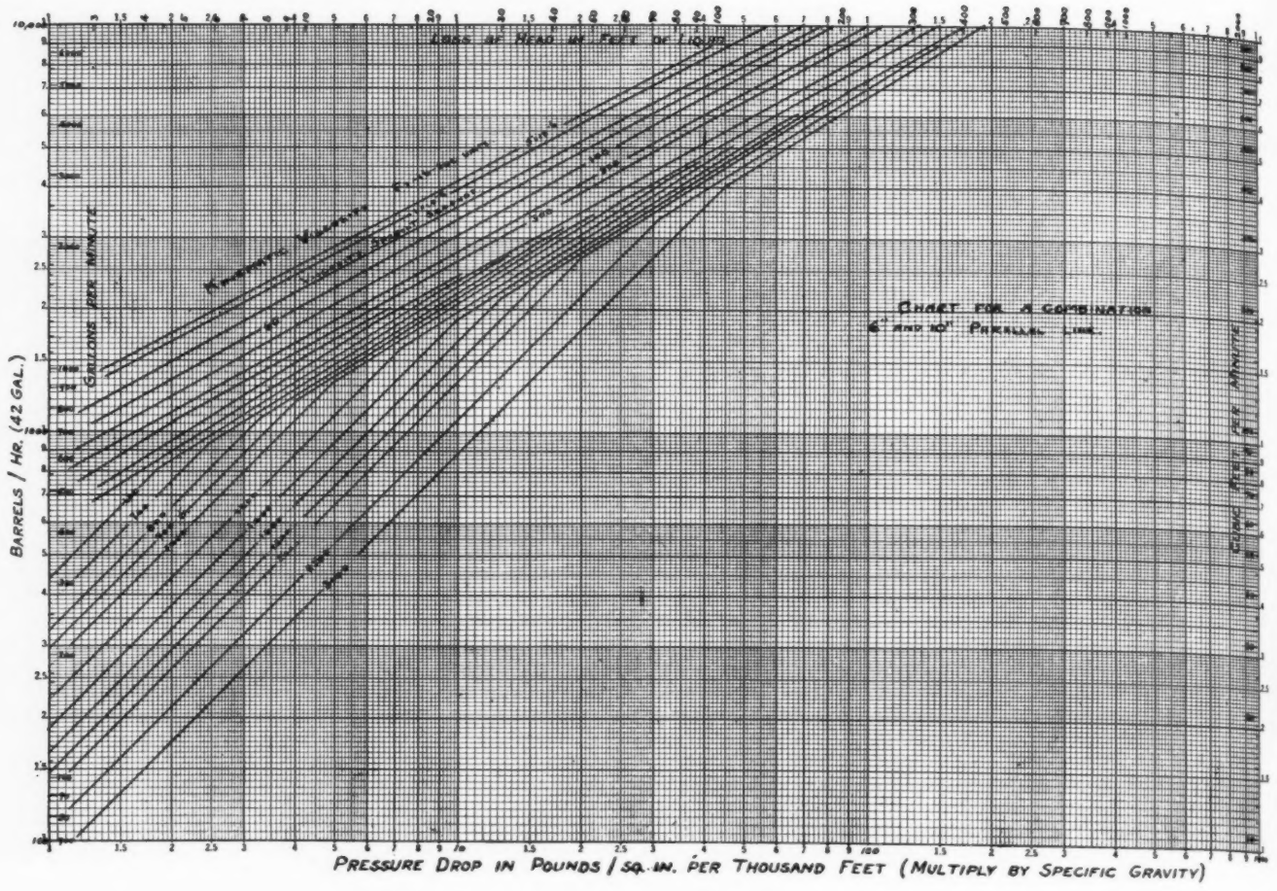
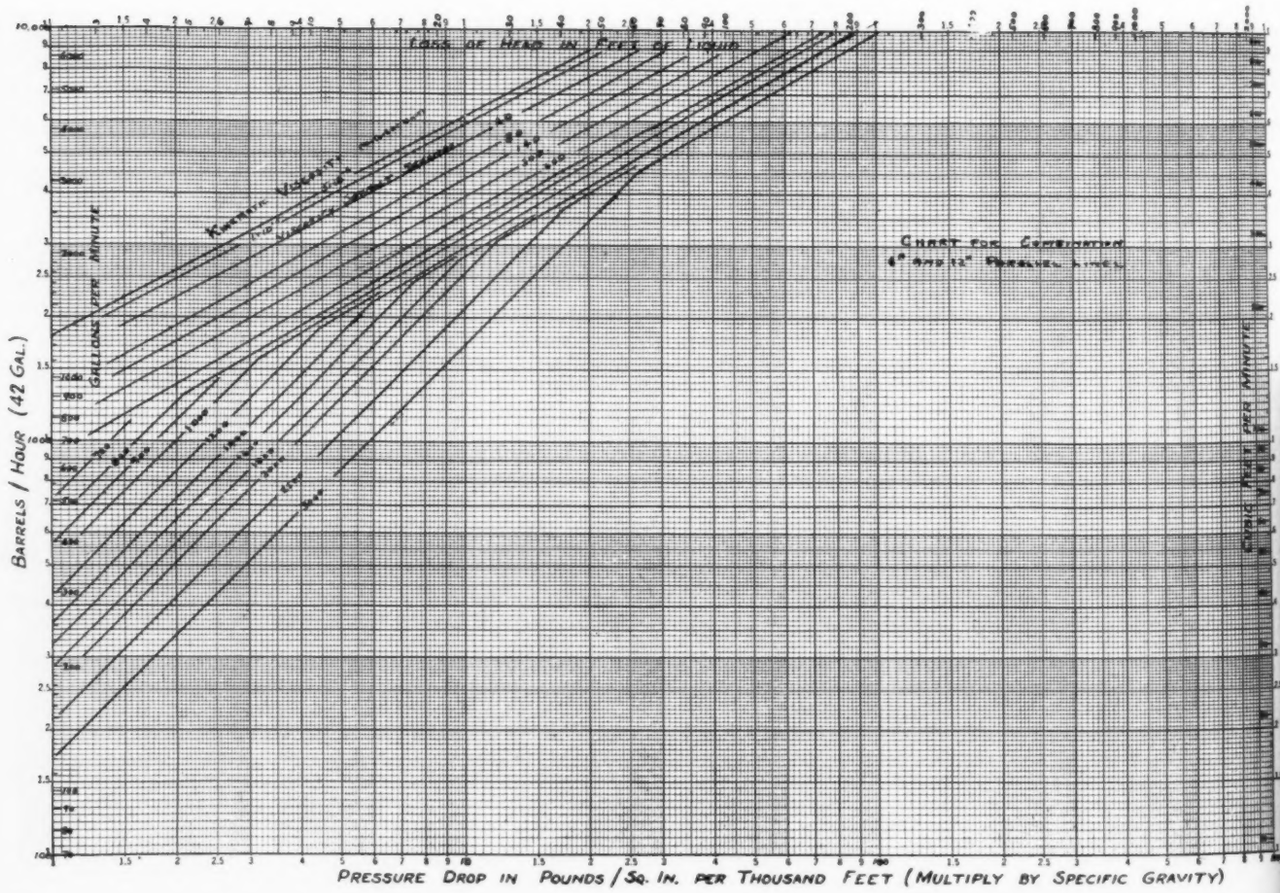

Loss of Head in Feet of Liquid
Barrels / Hour (42 Gal.)
Gallons per Minute
Cubic Feet per Minute
Chart for Combination
4" & 3" Parallel Line
Pressure Drop in Pounds / Sq. In. per Thousand Feet (Multiply by Specific Gravity)


Loss of Head in Feet of Liquid
Barrels / Hour (42 Gal.)
Gallons per Minute
Cubic Feet per Minute
Chart for a Combination
6" and 8" Parallel Line
Pressure Drop in Pounds / Sq. In. per Thousand Feet (Multiply by Specific Gravity)


Loss of Head in Feet of Liquid
Barrels / Hr. (42 Gal.)
Gallons per Minute
Chart for a combination
6" and 10" Parallel Line
Pressure Drop in Pounds / Sq. In. per Thousand Feet (Multiply by Specific Gravity)

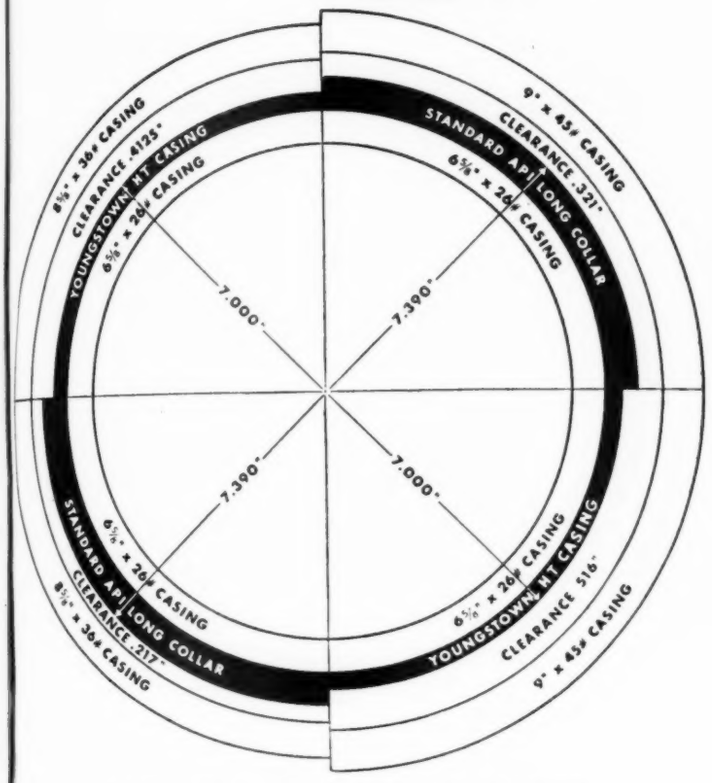

Loss of Head in Feet of Liquid
Barrels / Hour (42 Gal.)
Gallons per Minute
Chart for Combination
Pressure Drop in Pounds / Sq. In. per Thousand Feet (Multiply by Specific Gravity)

# INTRODUCING

OIL COUNTRY

YOUNGSTOWN

PIPE




THE YOUNGSTOWN SHEET AND TUBE COMPANY

Manufacturers of Carbon and Alloy Steels

General Offices - YOUNGSTOWN, OHIO

Youngstown's pipe is distributed by --

THE CONTINENTAL SUPPLY CO., Dallas, Texas

REPUBLIC SUPPLY CO. OF CALIFORNIA, Los Angeles

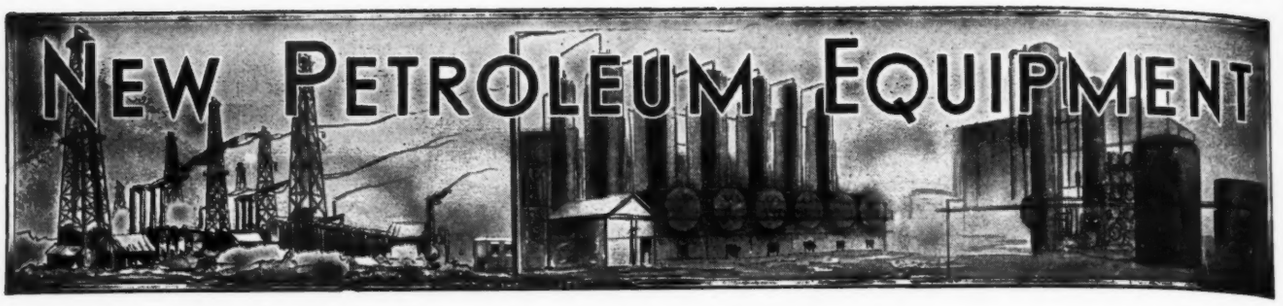
THE YOUNGSTOWN STEEL PRODUCTS CO., Dashwood House, Old Broad Street, London, E. C. 2, England

•The smaller diameter coupling of Youngstown H-T Casing gives greater clearance and reduces under-reaming cost. Tensile strength of joint is equal to Grade "D" long-coupling joint. Standard A. P. I. threads permit interchangeability. Produced in all standard sizes.

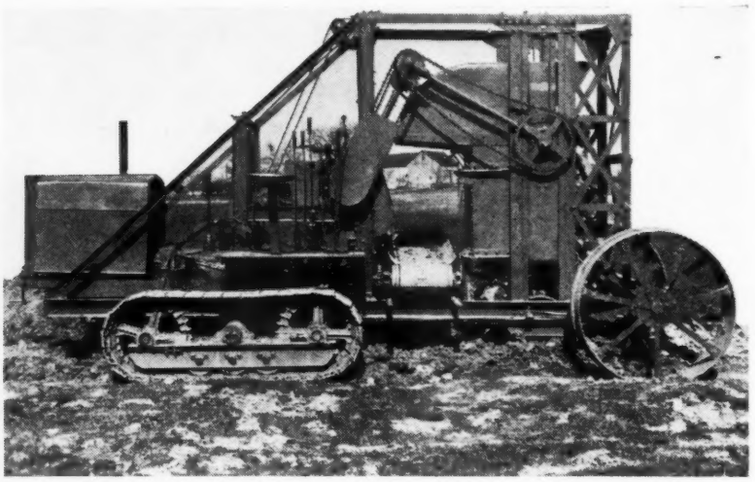
# YOUNGSTOWN H-T

## HEAT TREATED · HIGH TENSILE · HIGH TEST

# CASING




## Buckeye Announces Power Machine for Unearthing Pipe Lines



A NEW pipe stripping machine placed in the field within the past few weeks by the Buckeye Traction Ditcher Company of Findlay, Ohio, is attracting a great deal of attention because of its new approach to the problem of uncovering pipe lines. This new Buckeye machine makes possible the elimination of costly hand-digging operations and speeds up the work to a remarkable degree, the manufacturers state.

The Buckeye Pipe Stripping Machine uncovers the pipe so that the raising crew can follow immediately to hoist the pipe in position for cleaning. The machine not only digs down to the pipe, but also plows out the trench on either side of the pipe to a depth of one-half the diameter of the pipe, leaving the pipe fully exposed, all without the necessity of any pick and shovel gang following along to take out the last half foot or so of dirt.

Another feature of this Buckeye machine is the accuracy with which it follows the pipe. The digging mechanism is located directly between the front wheels of the machine and the weight of the digging assembly rides on the uncovered pipe, supported by a concave roller shaped to fit the size of the pipe. By means of a swivel connection to the digging boom the roller is permitted to follow accurately the contour of the pipe and any misalignment of the machine with the direction of the pipe line is registered immediately on an indicator in front of the operator. A touch of the power steering lever corrects the direction of the forward travel of the machine so that it follows accurately the pipe line at all times.

Important, too, is the ease with which the machine digs around saddles, clamps, expansion joints, and other similar obstructions on the pipe, with no danger of damage to the pipe line, it is pointed out by the manufacturers.

The frame of the pipe stripping machine is rigidly braced and all joints hot riveted or welded. Front wheels are 50½ in. in diameter, with 14-in. width of tread. The rear alligator wheels have a 13-in. tread with end sprockets 54 in., center to center, giving approximately ten sq. ft. of bearing area with bearing pressure of seven lb. per sq. inch. Steering is effected through standard power steering transmission.

The digging mechanism uses Buckeye type endless chain and self-cleaning buckets, operating on a digging boom set in a vertical position and mounted directly back of the front axle. A power hoist raises and lowers the digging boom. When the machine is in operation the weight of this boom is carried by a concave roller that rides the uncovered pipe. Bucket widths are available for trench from 16 in. to 30 in. wide and cutting depth up to four ft. is possible with the size machine now in the field.

The machine is built and powered for steady operation at speeds best adapted to the nature of the soil and other operating conditions. A 50-hp. Waukesha 4-cylinder motor of the heavy tractor type supplies ample power. Gearing gives a choice of four road speeds, forward or reverse, four bucket line speeds and 48 digging speeds, ranging from six in. to 33 ft. per minute. Average speed under normal working conditions will range from 10 and 15 ft. of trench per minute.

## New Chemical Permits Safe Use of Acid in Well Treating

THE American Chemical Paint Company, of Ambler, Pennsylvania, has developed a new chemical, called Murodine, for use with muriatic acid in acidizing wells. The manufacturer claims that Murodine prevents the action of the acid on well tubings and casings but does not hamper the action of the acid on lime stratas.

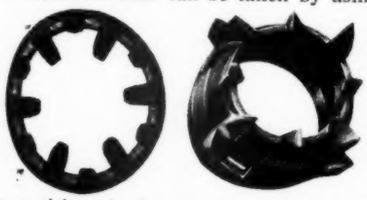
The process of using Murodine is called Murodizing and it is said by the manufacturers to be simple, inexpensive, and effective. Complete information can be obtained from the manufacturer.

## Globe Oil Tools Company's Type K Coring Equipment

DESIGNED to cut cores rapidly while maintaining a full gauge hole and obtaining maximum recovery in broken, floating, or soft formations, the Globe Oil Tools Company of Los Nietos, California, has developed a new Type K Coring Equipment. The improvements offered by the new design include a larger diameter core, an effective method of directing circulation to keep the blades clean, circulating ports close to bottom to wash away cuttings, a dog-type core catcher that is positive in operation, a floating inner barrel assembly without threads that permits the use of lighter pipe, and the elimination of the use of tongs on the inner barrel.

The diameter of the core recovered with the Type K outfit is about 50 per cent greater than the one taken by the old style core barrels. It is claimed by the manufacturer that this increased core diameter provides a greater percentage of recovery due to the increased columnar strength of the core; that it minimizes the hazard of washing away cores taken in soft formations; and that it obtains maximum drilling speed by having correspondingly less formation to be removed by the cutting blades.

The complete outfit includes the outer barrel, top sub, lifter sub, lower barrel sub, bit head sub, inner barrel, valve assembly, water connection, core pusher, and bit breaker. The core heads are provided separately and are furnished to cut hole from 5⅝ in. to 20 in. and to recover cores from 2⅜ in. to 6⅛ inch. Larger cores for hole sizes of 15 in. and over can be taken by using



a special outfit. In certain sizes, the new Type K core heads can be adapted to run with Globe-Smith outer barrels, types A, B, and C.

The Type K core heads are designed to permit repeated rebuilding. The teeth are arranged for rapid cutting, with lead teeth cutting a core that is amply protected from the washing action of circulation. Large outlets direct the circulation in front of the four large teeth to wash away all cuttings and constantly expose new formation to the cutting teeth.

The core catchers, placed in the heads just above the cutting teeth, are provided with alternating long and short dogs that are actuated by pressure between the outer end of the dogs and a shoulder in the bit head, and also by coil springs. All parts subject to wear are easily replaced.

All parts are made of the best material with the lower-barrel and bit-head subs cut with Acme threads. The inner barrel assemblies are made of a special grade thin-walled tubing and the two ends are welded on. There are no threads on the inner barrel, so tongs are never required. The valve assemblies are securely locked to the inner barrel by means of a latch that prevents the lugs from coming out of their notches.

Complete details on the construction and operation of the Globe Type K Coring Equipment will be furnished by the manufacturer.

## Republic Double Strength Steel

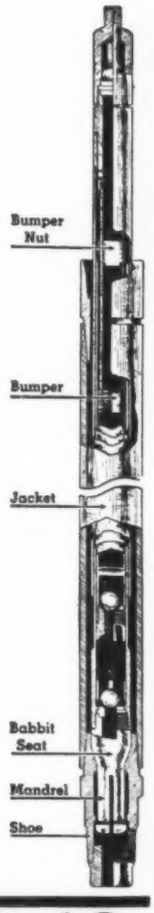
REPUBLIC Double Strength Steel is a new high tensile steel product of Republic Steel Corporation, Youngstown, Ohio. The new product is a copper-nickel-molybdenum ferrous alloy with yield point and tensile strength sufficiently higher than ordinary carbon steel to permit the use of 30 to 40 per cent lighter sections without sacrifice of strength or safety factor, the manufacturers state. Good corrosion-resistance and forming qualities make Republic Double Strength Steel particularly well suited for the construc-


# COMPLETELY PACKED
## *Yet the packing in this pump*
## *...NEVER WEARS OUT!*

**The fluid being pumped is the only packing used in The Fluid Packed Pump. Filling the annular spaces between the long, telescoping tubes it provides an effective seal against slippage even when used in deep wells and for handling light oil.**

**Any fluid lost from Fluid Packed Pumps must travel a distance of about thirty feet in an annular channel about 10/1000" thick, take a complete change of direction in its course, and, at the same time, displace the fluid packing which is acting as a buffer against slippage.**

**Thousands of successful installations throughout the oil fields of the world have proved the correctness of the Fluid Packed principle, not only when applied to troublesome wells but in regular production work.**




*Complete ordering information will be found in your 1935 Composite Catalog.*

**FLUID PACKED PUMP CO.**
**BOX 64 • LOS NIETOS, CALIFORNIA • U.S.A.**
**MID-CONTINENT AND TEXAS DISTRIBUTION**
**FLUID PACKED PUMP CO.—MID-CONTINENT**
**2 S. E. 29TH ST., OKLAHOMA CITY, OKLAHOMA**
**Gulf Coast Headquarters: 409 Velasco St., Houston, Texas**
**London Office: Coventry House, South Place, London E.C. 2, England**
**A MODERN PUMP FOR MODERN CONDITIONS**
Protected by Patents No. 1545474, 1545475, 1549175, 1621046; others pending.

tion of railroad, truck, and bus transportation equipment, it is pointed out.

Republic Double Strength Steel is made in two carbon ranges and is available in the usual commercial forms. It can be arc, gas or spot welded without loss of ductility at or adjacent to the weld. Cold forming tests have shown the superiority of this alloy from the standpoint of ductility, the makers claim.

## Braun Corporation's Smith-Emery Tank Sampler

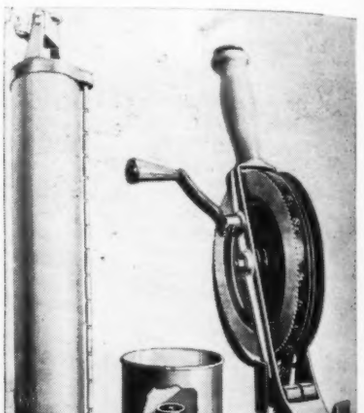
THE Braun Corporation, Los Angeles, California, has placed on the market the Smith-Emery Tank Sampler. The manufacturers state that the device applies to the problem of tank sampling a principle that already has been thoroughly established in other applications, taking a running sample from the surface or from any point below the surface to any desired depth. The sample taken contains a fixed amount of the tank content for every unit of depth penetrated. The resulting sample is obtained mechanically and is unaffected by the viscosity, pressure, size of tank, or any variation of stratification that may be present. Every stratum or zone, regardless of its character, is represented in the sample in exactly the same ratio as the stratum itself bears to the total content of the tank, it is stated.

The Smith-Emery Tank Sampler comprises three major elements.

(1) A brass cylinder of slightly less than one-quart capacity, open at the top and fitted at the bottom with a simple, positively-acting ball valve. Within the cylinder is a close-fitting plunger, the movement of which collects the sample.

(2) A handle and frame carrying two reels of slightly different diameters, mounted on a common shaft. The use of a recently developed aluminum alloy in these parts permits a design of substantial dimensions and rugged strength, but keeps the weight down to the limits of easy portability.

(3) Two 50-ft. steel tapes, one wound on each reel. One tape connects with the cylinder, the other with the plunger.



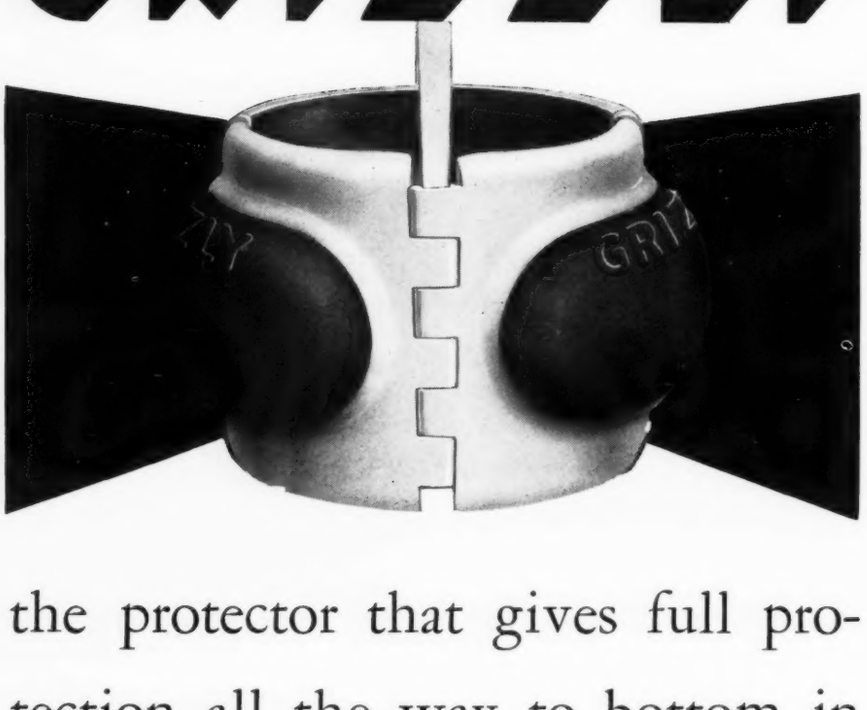
The reel carrying the tape to the cylinder is keyed to the shaft, and is revolved by means of a hand crank. The reel carrying the tape to the plunger is free on the shaft. By manipulating a small handwheel on the frame, the plunger reel may be (a) clamped to the other reel and revolved simultaneously with it, or (b) be clamped to the frame and held immovable, or (c) be kept free to revolve independently.

A ratchet brake on the handle of the frame controls the rotation of the reels so that the sampling cylinder can be stopped and held stationary at any desired point during the sampling.

Attached to the side of the cylinder is a 16-in. extension rod, notched in inches and locked or released by a convenient catch. It can be extended below the nose of the cylinder and thus automatically stop the sampling at any point up to 16 in. from the bottom of the tank.

The sample is discharged from the cylinder into the container by means of a special funnel, so designed that the sample cannot be contaminated by oil dripping from the exterior of the cylinder. At no time is any part of the sample exposed to the air, thus there is no loss from evaporation. Discharge is effected by a fixed trigger in the funnel that releases the ball valve.


GRIZZLY



the protector that gives full protection all the way to bottom in the deepest wells in the world.

The patented locking feature gives the Grizzly Protector a vice-like grip that will withstand any blow or strain ordinarily encountered in service, insuring longer life and better protection.

E. M. SMITH COMPANY

600-650 South Clarence Street, Los Angeles, California

Distributed by T. T. WORD SUPPLY CO., Inc., Houston, Texas, in all their stores

## MacClatchie Pump Liners

DUE to an increase in its liner business the MacClatchie Manufacturing Company, Compton, California, is purchasing the tubing for its hardened and ground

liners in carload lots. The picture shows a recent shipment of 24 tons.

This tubing is made to special specifications at the mill and shipped to the MacClatchie Manufacturing Company, which, company officials state, has the sole right to manufacture pump liners under U. S. Patents No. 1,592,266 and 1,837,675. The MacClatchie liner incorporates the advantages of low manufacturing costs plus highest quality and greatest operating economy, according to the manufacturer.

## One-Hand Grip and Locking Arm Feature Rod Hook

SAFETY, convenience, and speed in handling rods have been combined in the newly designed rod hook made by the Byron Jackson Company, 2150 East Slauson Ave., Los Angeles, Calif. With a locking arm providing safety from the standpoint of both construction and operation, an increase in speed and convenience in handling the tool has been obtained by means of a natural, one-hand grip at the center of balance combined with a convenient method of opening and closing the hook.

In this BJ Rod Hook, the grip that operates the releasing mechanism is in the shank of the hook at the center of balance so that the operator can, with one hand, steady the hook, open the locking arm, and engage or remove the bail of the rod elevator. The locking arm that connects the bill to the body forms a closed C-link that both increases the strength and eliminates the repeated flexing of the hook under load. The tendency to fatigue and crystallize the metal is thus removed. Moreover, any possibility of the elevator bail becoming disengaged is eliminated, since the locking arm can only be unlatched by the operator.

The locking arm is held in closed and locked position by a suitable spring until the operator grasps the releasing mechanism. While the releasing mechanism is compressed, the locking arm remains open; but instantly closes after the elevator bail is safely within the hook and the operator releases his hold.

The BJ Rod Hooks are furnished in three sizes: the "10", the "15" and the "20". These numbers indicate the capacity in tons with a factor of safety of three based on the elastic limit of the metal. In order to ease the tension on the threads of sucker rods in handling long strings, the "20" rod hook is constructed with two strong springs, one enclosed within the other, to provide a 4-in. travel with a soft, powerful action, but without unduly increasing the overall length. These springs have sufficient strength to lift the section of rods being unscrewed, thus reducing the possibility of burring and offering greater convenience in operation.

A data sheet and complete details of construction and operation can be obtained by addressing the manufacturer.

## Youngstown's Yoloy

A new alloy steel has just been announced by The Youngstown Sheet & Tube Co., Youngstown, Ohio. This new product, known as Yoloy, is a nickel copper alloy steel, having an exceptional resistance to corrosion, high tensile strength combined with high ductility, workability and weldability, the manufacturers state.

Yoloy steel is produced in sheets, strips, plates, bars, shapes, wire, and seamless pipe.


# COOK'S PISTON RINGS reduce cylinder wear

*in the* 57 WORTHINGTON Gas Engine Compressors *serving the* CHICAGO-AMARILLO Natural Gas Line

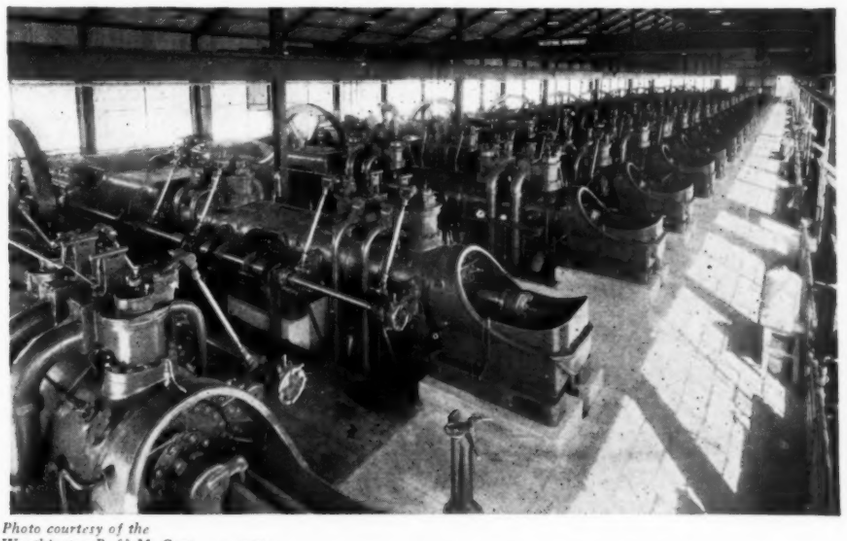


*Photo courtesy of the Worthington P. & M. Corp.*

COOK'S GRAPHITIC IRON PISTON RINGS

1368 **COOK'S Plain Rings** for the power cylinders, and 456 **COOK'S Segmental Rings** for the 800-lb. compression cylinders, were used in these 57 gas engine compressors. COOK'S Rings were chosen because the remarkable wearing properties of COOK'S GRAPHITIC IRON assure economies in operation and maintenance — economies resulting from **reduced cylinder wear — added years of engine life — fewer shut-downs for repairs.** WRITE for informative literature about COOK'S Plain Rings, and COOKTITE Sealing Rings and **SPECIFY COOK'S RINGS on your next order.**

**C. LEE COOK MANUFACTURING CO.**
**Incorporated**
**LOUISVILLE, KY.**

New York Cleveland Los Angeles Baltimore Chicago Tulsa New Orleans San Francisco

## New Deal Pipe Cleaning Machines

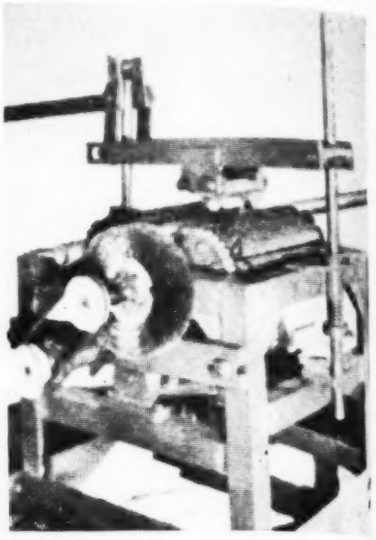
THE New Deal pipe cleaning machines, manufactured by the New Deal Specialty Co., Inc., Okmulgee, Oklahoma, proved of unusual interest to oil men attending the Houston Oil Show, because of their many unusual features and record of performance.

The machines are built in two models and five sizes. The De Luxe or Pipe Line Special is made in three sizes; the Regular Model in two sizes — Standard and Heavy Duty.

Features of the machines include safety automatic (self-locking) guide handle, dual hi-speed guide rollers, removable reversible blades, and dust proof bearings. The circular wire brush attachment operates with V-belt drive, and there is a special adapter for handling pipe as small as ¾ inch. The capacity of the machines is 2 in. to 13⅜-in. O.D. casing. The machine cleans a join of 9-in. O.D. casing in three minutes, including coupling and under the coupling, while a joint of 4-in. pipe is cleaned in 70 seconds.

Recent tests made on 8 machines included the cleaning of more than two million feet of pipe, at the conclusion of which all machines were in excellent condition with original brushes and cleaning blades intact, the manufacturer states.

The New Deal pipe cleaning machines are rapid, efficient and compact; easily transported and quickly installed; they are adaptable for electric, gas or gasoline power, and have proven very economical



Adapter for Small Pipe

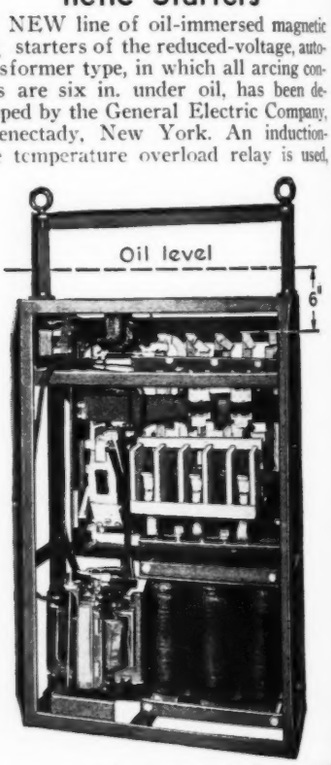
in operation, the makers point out. The blades are made of hard, tough, carborized steel, practically indestructible and wear proof. All machines are mounted on 25-in. frames, complete with brushing attachment and auxiliary stands, and clean and brush the pipe with one operation.

Write The New Deal Specialty Co., Inc., Okmulgee, Okla., for descriptive literature.

colox Keeps Control
GEO. S. MEPHAM & CO.
Slimy slick mud of low viscosity and the desired weight gives you control of the varying conditions underground. Heaving Shale, that troublesome headache, is being successfully drilled by using Colox. Operators say they feel most confident when they condition their mud with Colox.
GEO. S. MEPHAM CORP., 2001 Lynch Ave., East Saint Louis, Ill. for Mid-Continent and Gulf Coast areas and
C. K. WILLIAMS & CO., of California, Ltd., Shellmound Park, Emeryville for Pacific Coast area Under U. S. Patents Nos. 1,575,944-5 and 1,991,637
HEAVING SHALE
COLOX
COLLOIDAL IRON OXIDE

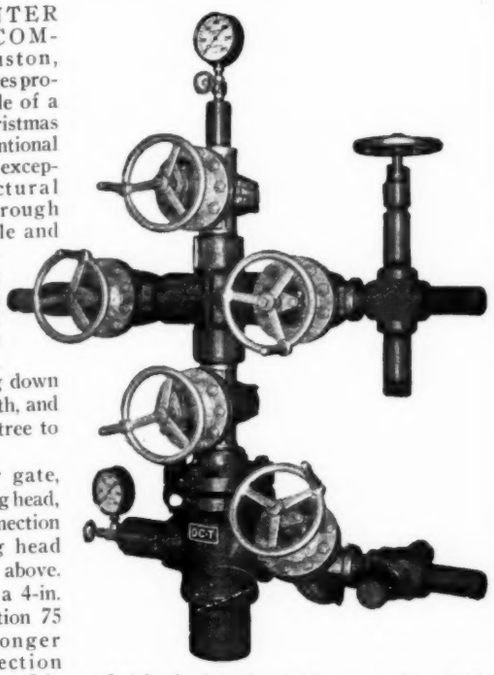

## G-E Oil-Immersed Magnetic Starters

A NEW line of oil-immersed magnetic starters of the reduced-voltage, autotransformer type, in which all arcing contacts are six in. under oil, has been developed by the General Electric Company, Schenectady, New York. An induction-type temperature overload relay is used,




also mounted in the oil. Either current-limit or time-limit acceleration is available, and an ammeter attachment can be supplied if desired. Ratings range upward to 600 amperes at 600 volts and 200 amperes at 2500 volts.

## Oil Center Tool Announces Streamline Christmas Tree



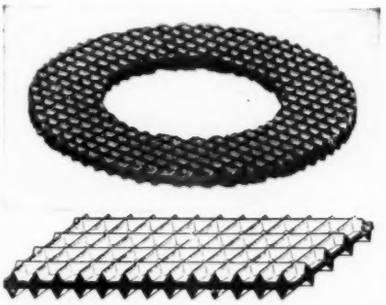
OIL CENTER TOOL COMPANY, Houston, Texas, announces production and sale of a streamline Christmas tree of conventional type having exceptional structural strength. Through use of all-male and male-and-female gate valves in the assembly, all nipples are eliminated, thereby cutting down the height, width, and weight of the tree to that extent.

The master gate, above the tubing head, has a male connection to the tubing head and the cross above. This provides a 4-in. thread connection 75 per cent stronger than a connection made with either 2-in. or 2½-in. hydraulic nipples, and also eliminates two thread connections. Above the cross a combination male-and-female valve is used, the male end of which screws into the top of the cross. Valves of the same nominal size as the tubing in the well may be used, since the well can be swabbed through the valves because of the absence of nipples, which normally reduces the swabbing opening through the Christmas tree. Side arm valves, as shown, are combination male-and-female, the male end screwing directly into the cross, again eliminating two thread connections on each valve. No tie-rods are necessary with this type of tree, inasmuch as male-end valve connection provides threads almost twice as large in diameter as normal. Another advantage pointed out by the manufacturers is the back pressure exerted by male-end valves. When 2½-in. valves are used on the flow arms, for instance, the opening into the valve is full 2½ inches. The discharge opening is reduced in proportion to the thickness of the nipple used to connect flow-line arms to the valves. This tends to reduce valve cutting.

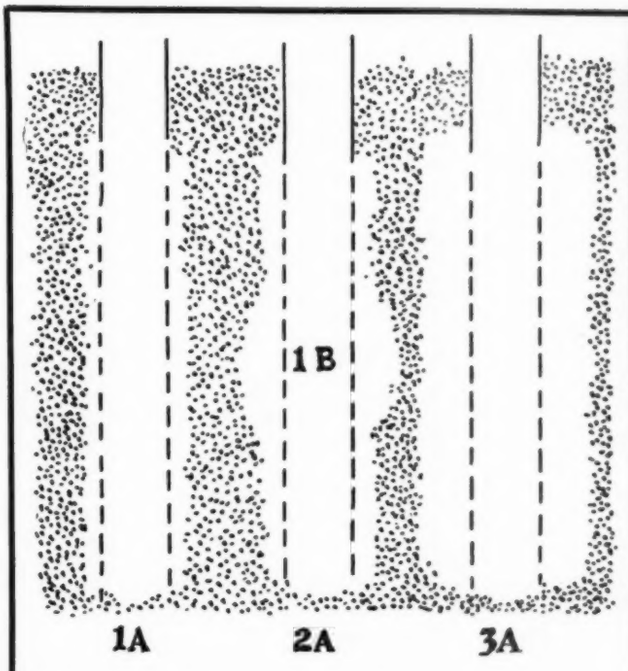
---

## Metallic or Semi-Metallic Gasket

THE new Multiseal Gasket, designed to withstand extreme pressure temperature change, and variation, is said by the manufacturer to produce perfect tightness with less contact surface, resulting in greatly reduced bolt pressure. This is accomplished by providing the faces with crossed ductile and resilient raised ribs, which under very small bolt pressure, are said to set themselves into tight contact even on imperfect flange faces. Inasmuch as making solid gasket metal uniform in thickness and keeping it free from surface nicks and scratches is almost impossible, the new multiseal construction offers a simple and effective means of producing and maintaining the correct surface and thickness, it is stated.



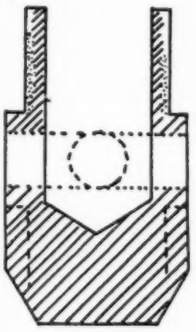
These gaskets are available as solid copper, steel, armco iron, aluminum, lead, or as a metal shell with asbestos filler, and in circular, elliptical or any specially desired shape. Multiseal Gaskets are made by Goetze Gasket & Packing Company, New Brunswick, New Jersey.


# How The Cavins Cleans Perforations

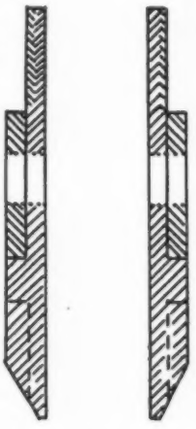
**When the Cavins goes off, the tremendous weight of the fluid washes back and forth through the perforations. These powerful fluid movements wash the sand in from behind the pipe, which increases the drainage area and multiplies production.**

**The types of shoes to use for washing perforations are shown by Fig. 1 and Fig. 2.**



**Shoe No. 1 is blank at the bottom, hence all the loading is through side holes.**

**Shoe No. 2 is the regular digging shoe which loads from the bottom, with holes in the sides to prevent rat holing, and should be kept open.**



**Shoe No. 2 should be run first, making six to eight feet of hole.**

**Shoe No. 1 should then be run, restricting all of the loading to the sides only. Run Shoe No. 1 as long as it makes a fair recovery.**

**Alternate these shoes and you will find it is the most up to date and positive way of cleaning out.**

**Illustration 1A shows hole cleaned with Shoe No. 2.**

**Illustration 2A shows hole cleaned down to 1B with Shoe No. 2. Then Shoe No. 1 was used at that point. Shoe No. 2 was then used to bottom.**

**In illustration 3A you can clearly see that by alternating the digging Shoe No. 2 and the formation Shoe No. 1, you increase the drainage area and multiply your production.**

***Write for complete information, prices, etc.***

## THE CAVINS COMPANY

2853 Cherry Avenue LONG BEACH, CALIF., U. S. A.

*Cable Address:* "Cavins, Long Beach"

R. J. EICHE, *Foreign Representative*

*Branches at:* Taft, Bakersfield, Goleta and Santa Paula, Calif.

CAVINS CLEAN-OUT SERVICE:
Oklahoma City, Okla., and McPherson, Kansas

CAVINS BAILER SERVICE:
Houston and Kilgore, Texas, and Shreveport, La.

# LAUGH WITH BARNEY

Edited by BARNEY HORRIGAN

### Even Going to Heaven Doesn't Change Them

An oil promoter appeared at the pearly gates asking admittance, but was told by Saint Peter there was already a surplus of oil men in Heaven.

"But, Pete," the man protested, "can't I just step in to see how it looks before I go below?"

Whereupon Saint Peter, being a kind-hearted individual, escorted him through pearly gate number three and out into the center of the city paved with precious metals. Here he pointed out a large number of promoters who had arrived earlier, thereby creating an oversupply. The oil promoter could hardly believe so many of his tribe had been admitted, but upon being assured they were bona fide oil promoters, he suddenly shouted to them through cupped hands, "They've struck oil down in Hell! They're drilling for oil down in Hell!"

Plop! Plop! Plunk! sounded, as the promoters hit the chute for Hell. In five minutes Heaven was completely denuded of all others, and St. Peter turned to the new arrival to tell him that he might as well stay now that there was room for him, but to his amazement, he saw the coat-tail of the man vanishing in the direction of the chute.

St. Peter, by dint of sprinting, managed to get in shouting distance of the speeding man, again urging him to stay. As he vanished down the chute he called back, "On second thought, there may be some truth in that statement, and I want to be on hand if there is."

* * *

"Do you believe in fate?" he whispered as she snuggled closer to him.

"Well," she answered, "not exactly, but I do know that what's going to happen will happen."

* * *

"After all," interrogates a fashion tip item, "where would a woman be if it were not for her clothes?"

We don't want to appear old-fashioned, but we hope—in her bath.

* * *

Titian—The color a poor redheaded girl's hair becomes as soon as her dad strikes oil.

* * *

Coming around a bend he saw a large gang of men dawdling at some road work. They were giving a very creditable imitation of how not to work. "What's going on here?" he asked. "Oh, this is a PWA job," said the foreman. Looking down the road a short distance he saw a man who was making the dirt fly like a doughnut tire in a mud hole. Pointing to the energetic worker, he asked, "Who's that chap who's making the dirt fly?" "Him," said the foreman, "—oh, he's a Republican."

—*Louis Allis Messenger.*

* * *

### Thanks!

You kissed and told
But that's all right—
The man you told
Called up last night.

—*Sage Hen.*

* * *

Then there's the chorus girl who gets a grand, and glorious feeling every time the millionaire kisses her.—*Owl.*

* * *

The mistress of the house heard the bell ring and saw standing at the open front door a Chinese hawker. Quickly retreating, she called out to the maid:

"There's a Chinaman at the door. You go, Ellie."

This was too much for the Chinese, who stuck his head into the hall and shouted indignantly:

"You go 'ellie yourself!"

* * *

*Jim:* Had yer kid christened yet?

*Miller:* Nothin' doin'! No kid of mine's going to git hit over the head with a bottle.

* * *

*Irate Tourist:* Now, see here officer, I was proceeding with the green light at a very moderate speed when this man ran into me. Yet you have the nerve to tell me that it was entirely my fault.

*Officer:* It certainly was and you could never make me believe otherwise.

*Irate Tourist:* Why?

*Officer:* Well, you see, his father is mayor, his brother is chief of police, and I go with his sister.

* * *

"I'd been in the hospital only a week when complications set in."

"Merciful Heavens! What happened?"

"The day nurse caught me kissing the night nurse."

*Patron:* Your hands are pretty dirty, aren't they?

*Barber:* Yeah, I haven't shampooed anyone today.

* * *

*Dentist:* Do you use tooth paste?

*Victim:* No, sir. My teeth aren't loose.

* * *

The high heel was invented by a woman who was kissed on the forehead.

* * *

A vagrant, when taken to the police station, was told to strip for a bath.

"What, go in the water?" he asked.

"Yes, you need it. How long has it been since you had a bath?"

"Well, I never was arrested before."

—*Bridgeport Bulletin.*

* * *

### Learning Fast

*Cop:* Miss, you were doing 60 miles an hour.

*Rose:* Oh, isn't that splendid! I only learned to drive yesterday.

* * *

*Sidney:* Life has been cruel to me. At the age of 18 I was left an orphan.

*Ed:* What did you do with it?

* * *

*Frank:* I don't see how you tell those Smith twins apart.

*Hank:* That's easy. Mabel always blushes when we meet.

—*Princeton Tiger.*

* * *

Our idea of a bloated plutocrat is a guy who never opens his laundry until two or three days after it comes.

* * *

### Spring Has Came to Arkansas

Spring has came and
Winter has went,
And, it ain't no accident.
The birds have flew as you have saw;
And, Spring has came to Arkansas.
(To be recited through nose).

* * *

*First Mosquito:* Hooray! Here comes a new arrival!

*Second Mosquito:* Fine! Let's stick him for the drinks.

* * *

*Boss:* Say, what does this mean? Someone called up that you couldn't come to work as you were sick.

*Man:* The joke's on him. He wasn't supposed to call up until Friday.

## Fred E. Foster Made Manager of California Oil and Gas Association

FRED E. FOSTER

Fred E. Foster, for the past three years secretary of the Pacific Coast Petroleum Industries Committee, has been made managing director and secretary of the California Oil and Gas Association. His appointment is, in effect, a consolidation of the two organizations, for, in addition to his new work with the association, he will continue his duties with the Petroleum Industries Committee.

Organized in 1906, the California Oil and Gas Association today represents 85 per cent of California petroleum production and every branch of the industry. The Petroleum Industries Committee was organized three years ago by the Pacific Coast marketing industry as a division of the American Petroleum Industries Committee to handle public relations work.

Foster, a petroleum engineer, is a graduate of the Carnegie Institute of Technology. During the world war, he was a colonel with the American Expeditionary Forces. Since the war, he has been identified with a number of California oil companies.

## Move New York Office

The New York City office of the Ross Heater and Manufacturing Company, Inc., was moved recently to 40 West 40th Street.

## L. C. Bradford Made Texas Panhandle Representative for Rector Well Equipment Co.

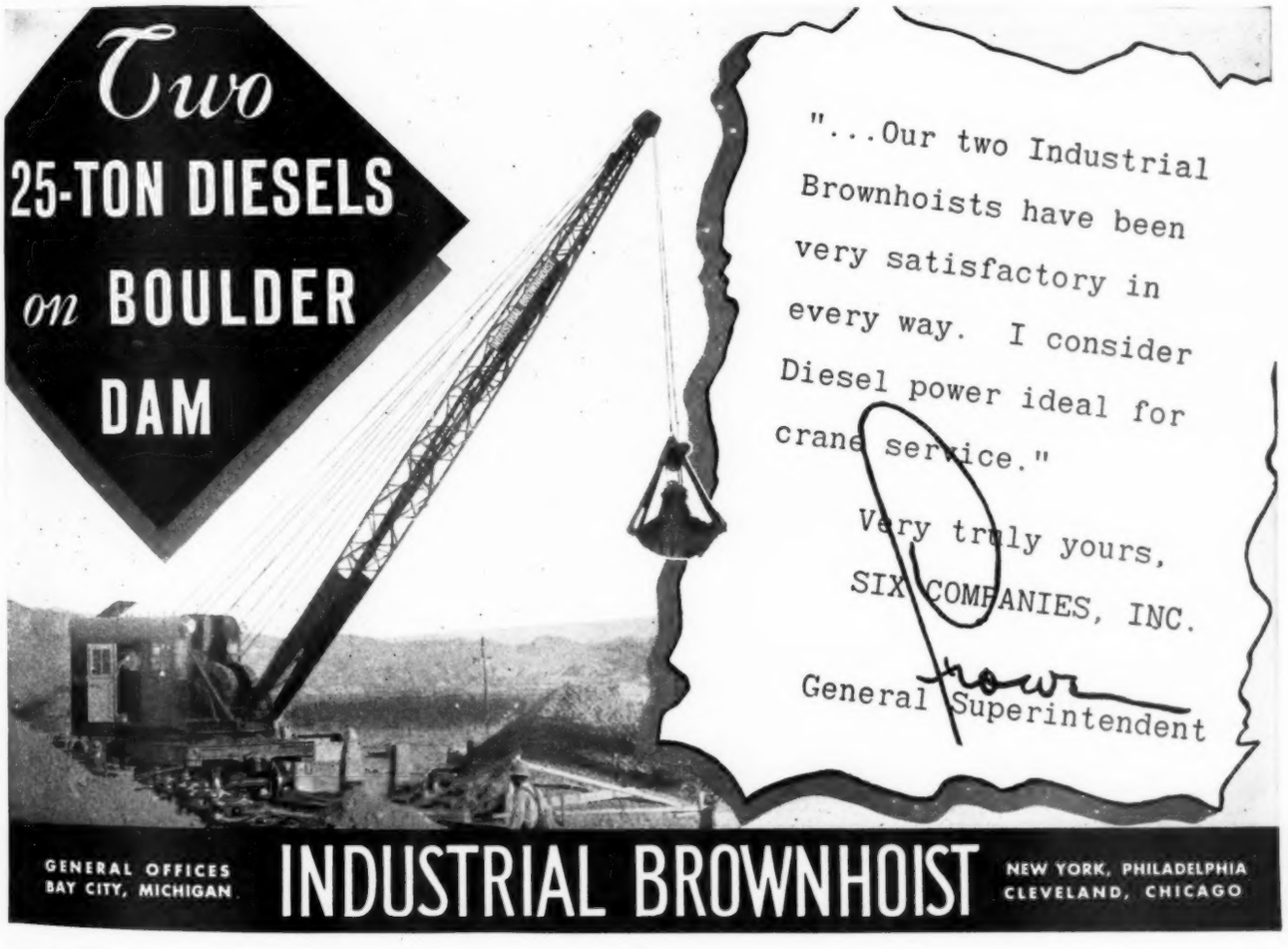
L. C. BRADFORD

Rector Well Equipment Company, Inc., Fort Worth, Texas, announces the appointment of L. C. Bradford as district sales representative in the Texas Panhandle territory, with headquarters at Pampa.

Bradford's experience in the equipment business began in 1918. For six years he represented as branch manager the Bradford Rig and Reel Company, in Haynesville, Louisiana, Smackover, Arkansas, and Mexia, Texas. Later he was district manager in the Texas Panhandle for American Tank for seven years, and was Black, Sivalls & Bryson's representative in the same district for one year.

## Oliver H. Attridge Is New Chief Engineer Lucey Products Corporation

Oliver H. Attridge, formerly chief engineer for Lucey Manufacturing Corporation, Chattanooga, Tennessee, has joined the organization of Lucey Products Corporation, Tulsa, Oklahoma, and will serve as chief engineer for that concern. Attridge has had extensive experience in designing and building drilling equipment.

*The* **WORLD'S DEEPEST WELL OVER 12,300 FT.**

TEN TIMES deeper than the height of the Empire State Building!

# 2 1/3 miles deep

## What Kind of PROTECTORS *are being used?*

"Hats off" to the engineers and crews of the record-breaking deep well in the McElroy (Texas) field. They've pushed the bit down deeper than ever before penetrated —close to 12,500 feet. They've been aided by Patterson-Ballagh Pipe and Casing Protectors. Practically EVERY deep rotary well in the world has been drilled with Patterson-Ballagh Protectors.

*Photo of Patterson-Ballagh Protectors on Pipe Used in Record-breaking Deep Well in McElroy Field, Upton County, Texas.*

# Patterson-Ballagh's of course

*Demand the genuine, for successful deep drilling.*

Patterson-Ballagh Corporation

*Plant and General Offices:* 1900 East Sixty-fifth St., Los Angeles, Calif., U.S.A.
*Texas and Gulf Coast Distributors:* BETTIS SALES COMPANY
516 Merchants and Manufacturers Bldg., Houston
*Oklahoma Office:* 123 Northwest Thirty-second St., Oklahoma City
*New York Office:* 39 Cortlandt Street

## Sales Representative for Edward Valve

Arthur C. Hays, 1415 Carondelet Building, New Orleans, Louisiana, has been appointed sales representative for The Edward Valve and Manufacturing Company, Inc., East Chicago, Indiana, in the New Orleans district.

## Non-Stop Distance Record Made by Diesel Tanker

With her Diesel engines running continuously from Texas to India—and then back to California—the motorship "Daylight" recently made what is said to be the world's longest non-stop voyage for a Diesel-driven vessel. Although head seas and head winds caused a 13.3 per cent propeller slip, the average speed was 10.1 knots per hour.

The oil tanker that established this distance record is owned and operated by Standard-Vacuum Company, of New York. A 3200-hp. Sun-Doxford Diesel main engine is accompanied by a pair of 120-hp. Cooper-Bessemer Diesel generator sets. Despite the large total of Diesel hp., the fuel consumption is low, it is stated. More than enough fuel oil can be carried to take the ship around the world, and at the same time not encroach very seriously on payload capacity, it is said.

After the first leg of the journey, to Bombay, when the engines were stopped, after running 51½ consecutive days and traveling 12,497 nautical miles, only a few minor adjustments were required. The return trip required 42 days. Only 11 gallons of lubricating oil were used per 24-hour service, including all auxiliaries.

## Leeds & Northrup Company and George Kent, Ltd., Announce Limited Agreement

An agreement, applying only to the sale of industrial electro-chemical instruments and certain types of flowmeters, has been consummated between Leeds and Northrup Company of the United States and George Kent, Ltd., of Great Britain. Under this agreement, Kent will not offer its industrial electro-chemical instruments or its flowmeters for sale in the United States or Canada unless through Leeds and Northrup, while Leeds and Northrup will not offer its similar instruments for sale in the British Empire (except Canada) unless through Kent. Neither the sale, in the States by Builder's Iron Foundry, of Kent venturi and shunt type rotary meters, nor the sale anywhere by either company or its agents, of products other than those specifically mentioned, is in any way affected, it is announced.

## Publisher's Statement of Circulation

This is to certify that the average circulation per issue of *The Petroleum Engineer* for the six months' period July 1st to and including December 31st, 1934, was as follows:

| | |
|---|---|
| Copies sold | 10,043 |
| Copies distributed free | 537 |
| Total | 10,580 |

(Signed) W. T. Bryan,
Secretary-Treasurer.

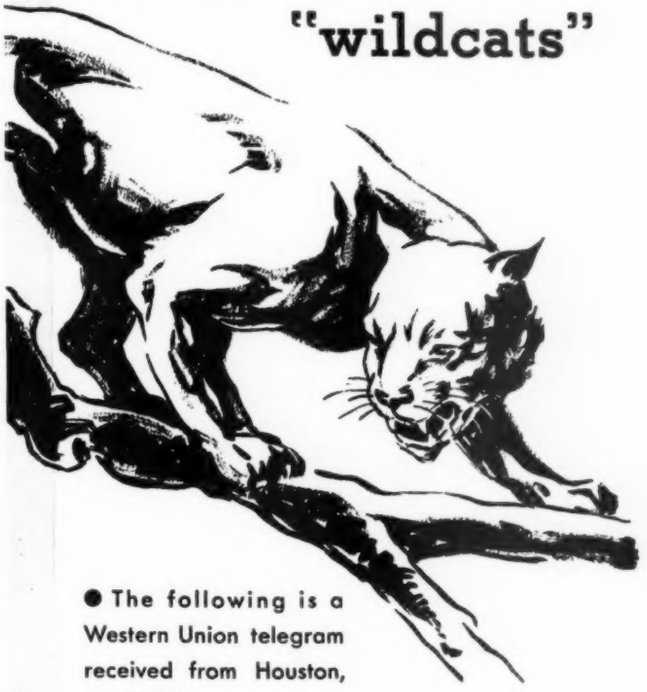
Subscribed to and sworn before me on this 9th day of May, 1935.

Gladys W. Williams,
Notary Public Dallas County.

(Notary's Seal)


**LAY·SET** *Preformed*

**whips the "wildcats"**



● The following is a Western Union telegram received from Houston, March 21st:

"Many companies always careful to specify Lay-Set Preformed Rotary Lines for all wildcat or deep test operations where conditions are uncertain. Stop. One company, drilling in Iowa field in Louisiana, used the same Lay-Set Preformed line to make 5600 feet with 6-inch pipe and 7400 feet with 4-inch pipe, then made 5500 feet on second well."

The frequency and the similarity of service reports on Lay-Set Preformed Rotary Lines proves that here is the one line that can tame the wildcats. Lay-Set Preformed is the rotary line that will consistently give more ton-miles of service. Send for literature. Learn why Lay-Set Preformed Rotary Lines are preferred wherever dependability of performance is an absolute necessity. Write today.

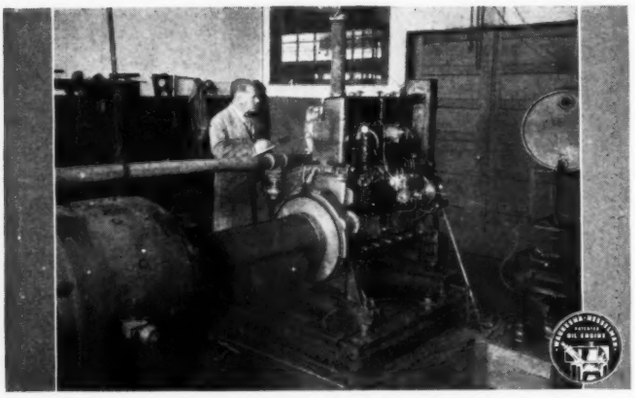
**HAZARD WIRE ROPE COMPANY, Inc.**
Wilkes-Barre, Pennsylvania
An Associate Company of American Chain Company, Inc.
*In Business for Your Safety*
*District Offices:* New York, Chicago, Philadelphia, Fort Worth, San Francisco, Pittsburgh, Denver, Los Angeles, Birmingham, Tacoma

NRA CODE ACCO

**LAY·SET** *Preformed* ROTARY LINES

# What fuels

## DOES THE HESSELMAN BURN?



Fuel test of 100 hp. Waukesha-Hesselman Industrial Engine in one of the Waukesha dynamometer rooms.

**Standard Waukesha-Hesselman Engines are built to operate on practically all clean, refined commercial fuels regardless of cetane number.**

**Fuels that are satisfactory in solid injection Diesel engines of equivalent speed range give equal satisfaction in the Hesselman. While the Hesselman and the high-speed Diesel are alike in this respect, the Hesselman operates smoothly and efficiently on many fuels that would be rough and detrimental to a compression ignition engine.**

**Lighter oils which lack inherent lubricating properties may be utilized in the Hesselman after this deficiency is made up by mixing a very small amount of engine lubricating oil with the fuel. Thus standard furnace oils, Nos. 1, 2 and 3, kerosenes and distillates as well as commercial high-speed Diesel fuels are available for use with Hesselman engines.**

**The practical significance of this is that suitable fuels may be found wherever high-speed Diesels are in use, and in many odd corners of the earth where only kerosenes or distillates are available.**

***Write* for Bulletin 1000. *Waukesha Motor Company, Waukesha, Wisconsin.***

**THIS IS No. 3 OF A SERIES** on the Hesselman Oil Engine. No. 4 will appear next month. A reprint of the complete series will be mailed on request.

# WAUKESHA ENGINES


## S. M. Jones Co. Publishes Booklet on Sucker Rods

The S. M. Jones Company, Tulsa, Oklahoma, has just issued a new booklet entitled "The Relation of Pumping Conditions to Sucker Rod Selection." The booklet is primarily an informational brochure designed to present a few fundamentals considered essential to satisfactory sucker rod performance, and its central thought in the matter of sucker rod selection is the fitting of sucker rods to pumping conditions.

Among the features of the booklet are a brief history, high-spotting some of the reasons why pumping conditions have changed, bringing the discussion up to the sucker rod problems of today. A statement also is made of the need for the establishment of a "method" or "practice" for fitting sucker rods to pumping conditions, and attention is called to two principal factors that will help to clarify these problems. A tabulation or suggested "method" for selecting sucker rods to fit the four principal pumping conditions is detailed.

The booklet is available free upon request.

## Sperry-Sun Opens Branches at Tulsa and Bakersfield; California District Office Moved

The Sperry-Sun Well Surveying Company, Philadelphia, Pennsylvania, has opened a district office at 425 Petroleum Building, Tulsa, Oklahoma, to serve the Mid-Continent fields. Morton T. Higgs is in charge.

Officials of the company also announce that a branch office has been established in Bakersfield, California, at 1237 K Street; and that the California district office has been moved from 415 Petroleum Securities Building, Los Angeles, to 549 East Bixby Road, Long Beach.

## W. A. Tipton to Houston Territory for U. S. Rubber

W. A. Tipton, formerly employed by the Iverson Tool Company of Tulsa, Oklahoma, has joined the mechanical goods division of the United States Rubber Products, Inc., and been assigned to cover oil accounts in the Houston territory, embracing approximately the south half of the state.

Tipton at one time was employed by the Standard Oil Company of Indiana. He has also been connected with the Durable Manufacturing Company, for whom he traveled several years.

He is well known and highly regarded throughout the Mid-Continent field.

## Baash-Ross Tool Co. Makes Promotions

At the meeting of the board of directors of the Baash-Ross Tool Company, Los Angeles, California, on May 1st, Erwin Burns was elevated from the position of vice-president and assistant general manager to vice-president and general manager. H. C. Ross, who was a vice-president and director, was made vice-president, director and general sales manager. Jack Schuyler was elected a vice-president and will act as a special representative in the United States.

## C. B. Nolte Made President of Crane Co.; J. B. Berryman Chairman of Board

C. B. Nolte has been elected president of Crane Co., Chicago. J. B. Berryman, who had been president since 1931, and who has been connected with the Crane organization since 1892, becomes chairman of the board.

Since 1909 — just after he received his Bachelor of Science degree in mechanical engineering at the University of Illinois — Nolte has been with the Robert W. Hunt Company, consulting, testing, and inspecting engineers. Successively he became division manager, manager, vice-president, and general manager, until in 1930, he was appointed president and general manager. This position he held until he was elected to his new office.

C. B. NOLTE

## Rudolf E. Schiefelbein Representing Kibele Manufacturing Co. in Southwest Texas

Rudolf E. Schiefelbein, well-known in Southwest Texas equipment circles, has taken over the representation in that district of all Kibele Manufacturing Company lines. He is maintaining headquarters in the building formerly occupied by the Kibele company at 201 East Cevallos Street, San Antonio, before it removed manufacturing plant and offices January 1st to Dallas. Associated with Schiefelbein is Alfred Brown.

Schiefelbein was connected with the San Antonio Machine and Supply Company for 20 years and has a wide acquaintanceship among operators in his territory. He is stocking a full line of Kibele pistons, swabs, and tubing catchers.

## R. Y. MacIntyre Now with Link-Belt at Dallas

Announcement is made by the Link-Belt Company, Chicago, that R. Y. MacIntyre, who has served as its representative in Memphis, Tennessee, since 1932, has been transferred to the company's district sales office and warehouse in Dallas, Texas, where he will assist E. G. Wendell, the local manager. "Mac," as he is more familiarly known to his many friends, has a wide acquaintanceship throughout the South.

## Ben Morey Joins Lane-Wells Co. Staff

Ben Morey, formerly president of Morey and Jones, Ltd., of Los Angeles, manufacturers of metering devices, has joined the staff of the Lane-Wells Company, manufacturers of oil tools and operators of Gun Perforator Service.

Morey is a mechanical engineer by profession, but has also had a wide experience in sales and manufacturing.

## To Distribute B & W Seamless Stainless Steel Pipe

The Horace T. Potts Company, Philadelphia, has been appointed distributor of seamless stainless steel pipe in that territory by The Babcock and Wilcox Tube Company, also continuing to distribute B & W seamless boiler tubes.


PERFORMANCE

SPEAKS

LOUDER

THAN WORDS

SO

INSTALL

AXELSON

PUMPS &

SUCKER RODS

AXELSON MANUFACTURING CO.
P. O. Box 710, Vernon Station, Los Angeles
St. Louis 50 Church St., New York Tulsa
*Mid-Continent and Eastern Distributor:* Frick-Reid Supply Corp.
*Rocky Mountain Distributor:* Great Northern Tool & Supply Co.

*Builders of Pipe Lines for the Oil Industry*

**B. & M. Construction Corporation**

**1313-15 Petroleum Building**

**Oklahoma City, Okla.**

**Phones 7-8844, 8-2685**

# Book Reviews

*Refrigerating Data Book and Catalog.* (Second edition, 1934-36). Editor, David L. Fiske. Published by the American Society of Refrigerating Engineers, 37 West 39th Street, New York City. 576 pp. Price, United States, $3.50; elsewhere, $4.00.

This, the second edition of a biennial series of handbooks on refrigerating engineering, is intended to reflect the state of that art, to assemble representative data, and to show where further information and discussion may be found. It offers in compact form up-to-date information and data on refrigeration and air conditioning. The volume is a compilation by many men. The "Data Book Committee," in addition to the editor, David L. Fiske, includes Alvin H. Baer, Harry D. Edwards, Crosby Field, Harry Harrison, Louis H. Morse, Glenn Muffly, Alfred W. Oakley, A. R. Stevenson, Jr., H. M. Williams, and Frank R. Zumbro.

The editorial policy of the book, in keeping with the policy of the society publishing it, is to sponsor and purvey, primarily, information that is general, basic or theoretical. Seventeen of the 30 chapters are new or wholly rewritten, and should make this volume even more valuable than the first edition.

* * *

*East Texas Oil Parade,* by Harry Harter. Published by the Naylor Company, San Antonio, Texas. 228 pp. Illus. Size 5 x 8. Cloth. Price $2.00.

*East Texas Oil Parade* is the story of land, oil, politics, and people concerned with the world's largest oil field. In it the author narrates and interprets the historic, economic, political, and social aspects of one of modern man's most thrilling conquests.

In unifying the many diverse aspects of the development of oil in East Texas, the author has achieved a dramatic story of great emotional appeal. While he recognizes the fact that petroleum played no part in the early colonization of East Texas, a resumé of the early history of the section is given, beginning with the activities of Stephen F. Austin—a fitting introduction to the accounts following concerned with the lawsuits and endless litigation arising from old Spanish grants. The story of early exploration for oil is recounted, the reader is introduced to "Dad" Joiner, who drilled the field's discovery well, and the later development of the field is discoursed upon.

The author, in a panoramic view of the past and present, draws some interesting conclusions concerning future possibilities in East Texas. His narrative also includes stories of East Texas that are strange and bizarre, but nevertheless true.

* * *

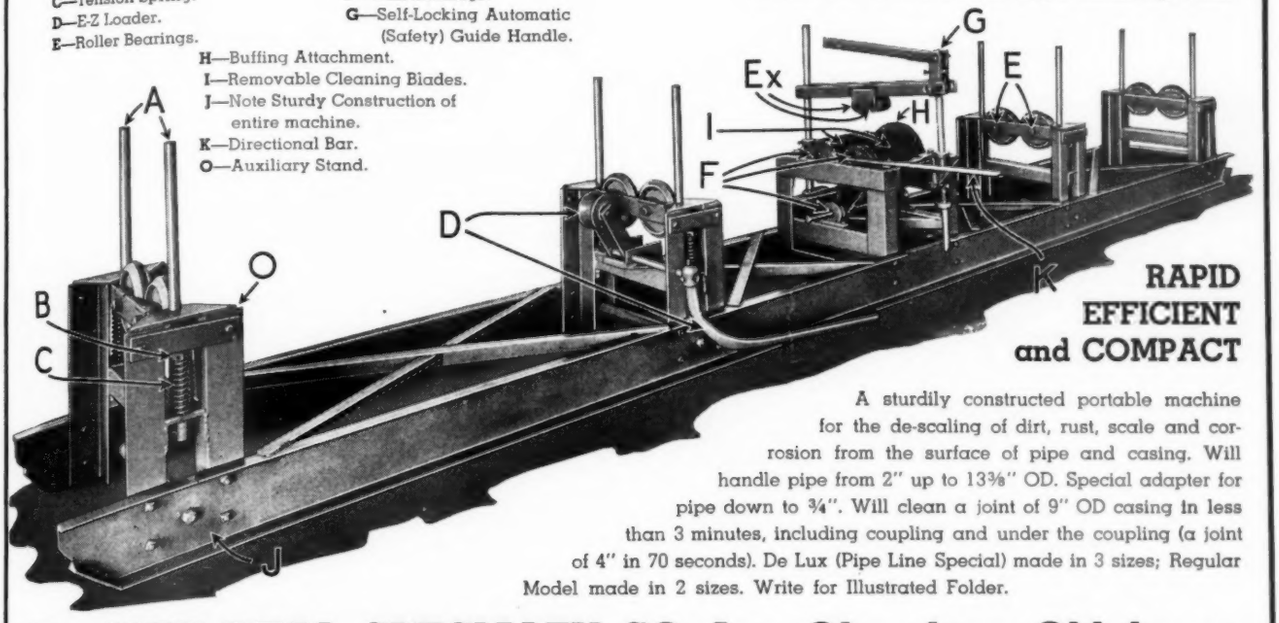
*Precautions for Workers on Construction and Maintenance of Refinery Equipment.* Published by the American Petroleum Institute, 250 Park Avenue, New York City, and issued by the Department of Accident Prevention of the A.P.I., Dallas, Texas. Price 25 cents.

In this publication is set forth the most practical and least hazardous methods by which the mechanical and labor group of refinery workers should carry on their work. The information has been developed from the practical experience of operating men and safety engineers who have investigated a large number of accidents and injuries. The volume contains a general section that applies to work on all types of equipment, and also has a section covering special kinds of work.

## Remove ALL Dirt . . . Rust . . . Scale and Corrosion . . . with The NEW DEAL PIPE CLEANING MACHINE

A—Removable Safety Bars.
B—Tension Adjustment.
C—Tension Spring.
D—E-Z Loader.
E—Roller Bearings.
E-X—Dual Roller Bearings (in each guide roller.)
F—Ball Bearings.
G—Self-Locking Automatic (Safety) Guide Handle.
H—Buffing Attachment.
I—Removable Cleaning Blades.
J—Note Sturdy Construction of entire machine.
K—Directional Bar.
O—Auxiliary Stand.

**A, B, C, D, and E, are Features Found ONLY on Our De Lux (Pipe Line) Special**

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## Important Investigations Being Made by California Natural Gas Association

The 1935 program of coöperative laboratory and engineering investigations being conducted by the California Natural Gasoline Association holds promise of yielding data of great importance to the natural gas and natural gasoline industry, according to P. S. Magruder, of the General Petroleum Corporation, chairman of C.N.G.A.'s Technical Committee. Five committees are actively working on problems dealing with (1) the deviation of natural gas from Boyle's Law; (2) the preparation of a new bulletin on the charcoal test; (3) a study of the new Reid test procedure recently proposed by A.S.T.M.; (4) the preliminary evaluation of a new method developed by the Standard Oil Company of California for the controlled weathering of charcoal test condensates under pressure; and (5) the joint participation with the Pacific Coast Gas Association and the Southern California Meter Association in the development of a revised code of gas measurement practice.

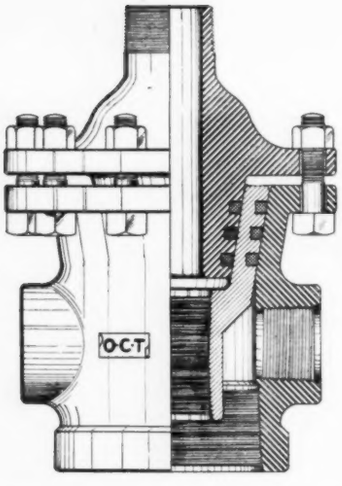
Committee No. 1, of which W. C. Dayhuff, of the Standard Gasoline Company, is chairman, has prepared a chart showing graphically the relationship between Boyle's Law deviations and gas specific gravity over the range 0.55 to 0.85 with an extrapolation to 1.000. The data for the plot were the results of work with synthetic gas mixtures. The mathematical analysis of the results and the drawing of the chart were carried out by W. Helmick of the Shell Oil Company.

Committee No. 2, of which C. D. Gard, Union Oil Company, is chairman, has carried a study of the charcoal test to the point where the committee will soon be ready to publish Part I of a new charcoal test bulletin that will deal exhaustively with the technique of saturating charcoal tubes in the field. Apparatus specifications, including tolerances, will be described. The distillation procedure will be published later as Part II.

Committee No. 3, of which R. R. Crippen, of The Texas Company, is chairman, has undertaken the assignment of making a series of comparisons between Reid test values obtained by the present pressure-sampling procedure in use in California, and those obtained with the revised test proposed by A.S.T.M. Committee D-2's sub-committee XXII. California refiners have been invited to participate.

Committee No. 4, of which H. J. Multer, of the Union Oil Company, is chairman, has inaugurated the study of the new charcoal still developed and recently introduced by the Standard Gasoline Company. This apparatus enables the distillation of saturated charcoal at 30 lb. and 32 deg. fahr. with a subsequent weathering of the condensate to a predetermined vapor pressure. The first step will be an examination of the method with reference to its ability to weather condensates to 20 lb. Reid.

Committee No. 5, of which P. W. Hill, of the General Petroleum Corporation, is chairman, is about to participate in the preparation of a Revised Gas Measurement Code. The work will be done by a joint committee of six, consisting of two members each from C.N.G.A., S.C.M.A., and P.C.G.A. Hill and W. L. Cowan, Union Oil Company, have been delegated to represent C.N.G.A.; B. G. Williams, of the Southern California Gas Company, and C. B. Heartwell, of the Standard Gasoline Company, will represent S.C.M.A.; and F. A. Hough, of the Southern County Gas Company, and P. E. Beckman, of the Pacific Gas and Electric Company, P.C.G.A.

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## Armstrong Bros. Announces New Lines

The new "B-35" General Catalog of the Armstrong Bros. Tool Company, Chicago, illustrates what one manufacturer has been doing during "the depression." Over 70 pages in size, the new catalog announces 35 new lines or additions to new lines, including: A line of permanent multi-purpose tools for turret lathes and screw machines that take standard shaped cutter bits; an extensive line of chrome-vanadium steel detachable head socket wrenches and wrench sets with a new "drive-lock" feature, an adjustment for locking sockets to drivers; a line of carbide cutters and tool holders; and a line of receding type pipe threaders.

## Axelson Guide Type Sucker Rod Coupling With Paraffin Scraper

According to R. M. Humphreys, assistant director of sales for the Axelson Manufacturing Company, Los Angeles, favorable reports are being received on the operation of the Axelson guide type sucker rod coupling with paraffin scraper. This device, constructed of hardened and ground steel, guides the rods in the tubing and provides ample fluid passage.

Recognizing the need of some device that would break up paraffin congealed within the tubing, Axelson engineers designed the paraffin scraper coupling. It is manufactured from the same material used in an Axelson hardened and ground sucker rod coupling, namely, nickel-molybdenum alloy steel. Controlled heat treating operations and extreme care in manufacturing processes have resulted in the guide type couplings being equal in all respects, from an operation and service life standpoint, to the regular hardened and ground sucker rod couplings, Axelson engineers state. Representatives of the manufacturer claim that these couplings, assembled in the sucker rod string at strategic points where paraffin collects and crooked hole conditions prevail, will increase sucker rod and tubing life, as well as reduce power costs.

## Addresses Oklahoma City Electrical Engineers

The Oklahoma City section of the American Institute of Electrical Engineers recently had as its guest lecturer, T. F. Peterson, consulting engineer for the American Steel and Wire Company. The lecture was arranged through C. M. Mackey, manager of the Westinghouse Electric Supply Company, Oklahoma City, and J. V. McGinity, of the American Steel and Wire Company, and members of the Oklahoma City section of the A.I.E.E. Peterson's subject was "The Romance of Electric Cables."

## Republic Steel's New York Office Moved

On May 1 the New York district sales office of Republic Steel Corporation, Youngstown, Ohio, was removed to the Chrysler building, according to an announcement by N. J. Clarke, vice-president in charge of sales for Republic.

W. H. Oliver continues in charge of the office as district sales manager. Republic's export department, under the direction of D. H. Bellamore, general export manager, also occupies a portion of Republic's new suite in the Chrysler Building.

# TRADE LITERATURE

*The Gaso Pump and Burner Manufacturing Company,* Tulsa, Oklahoma, has issued a new catalog, presenting the entire Gaso line of standard model pumps and fittings, together with specifications and other detailed information. The volume is fully illustrated. In addition to showing factory and field photographs, numerous drawings are used in which the various parts are numbered, making it easy for the reader to identify them. One section of the catalog is devoted to "general information," giving data on the use of friction tables, rules for calculating the speed of gears and pulleys, horsepower ratings of flat belting, a discussion of V-belt drives and their hp. ratings, a table showing friction loss in pipes of various sizes, etc. The catalog is being sent free upon request.

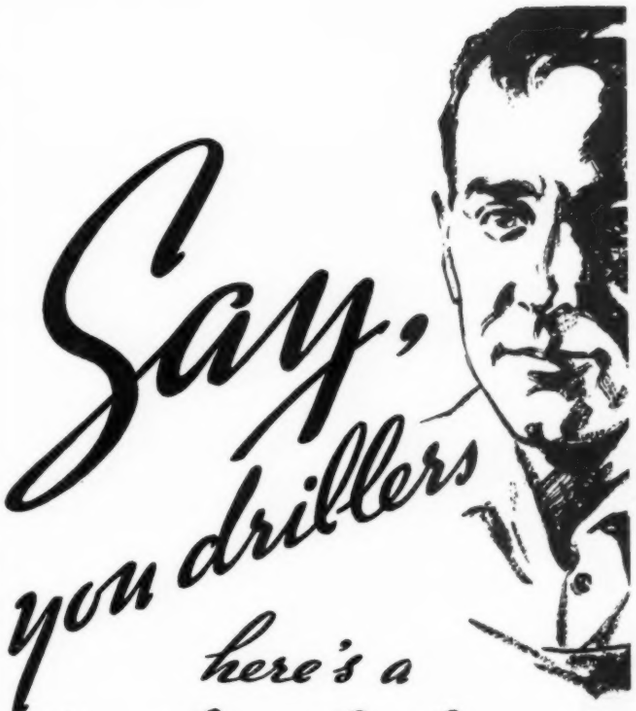
MERCO NORDSTROM VALVE COMPANY, subsidiary of the Pittsburgh Equitable Meter Company, Pittsburgh, Pa., has issued a 32-page bulletin describing "Merco" lubricants for Nordstrom Lubricated Plug Valves. This bulletin gives detailed information on the correct type of "Merco" lubricants to be used in more than 300 different services. Copies may be obtained by writing the Merco Nordstrom Valve Company, 400 N. Lexington Ave., Pittsburgh, Pa.

ACCORDING to the MacClatchie Manufacturing Company, Compton, California, their new "Hydro-Seal" plug valves provide perfect sealing and easy turning. Undercut grooves in the surface of the plug form metal "Hydro-Seal" lips which are expanded by grease pressure to engage against the wall of the body to make escape of pressure impossible, they say. No cup leathers or compressible packings are used, consequently friction is reduced to a minimum, it is stated. The new MacClatchie "Hydro-Seal" plug valve catalog has recently been issued, giving full details on this new development. A new general catalog, listing all MacClatchie products is now available also. The catalogs will be sent upon request.

The Republic Steel Corporation, Central Alloy District, Massillon, Ohio, is reprinting the "New S.A.E. Steel Specifications Chart." The chart is published with permission of the Society of Automotive Engineers, and copies will be sent free to those requesting them from the advertising department of the Republic Steel Corporation at Massillon, Ohio.

Kerotest Manufacturing Company, Pittsburgh, Pennsylvania, manufacturers of oil field valves and fittings for oil field service, has issued a 12-page bulletin describing its line of forged steel products. Complete descriptions and specifications covering its line of forged steel flange unions, crosses, tees, elbows, gauge valves, and control chokes are presented. Copies of this new informative bulletin will be sent on request.

"THE ANSWER TO YOUR BEARING PROBLEMS," an attractive four-page pamphlet just off the press, tells briefly the story of Bronzoid treated lead, which has been placed on the market following a year of tests in major shops throughout the country and in the fields. Microphotos, showing the better distribution of lead under the new process of producing bronze alloy bearings and bushings, are reproduced, and also actual photographs of bearings made from Bronzoid treated lead illustrate the comparison, after hard runs, with bearings made from other mixes. A copy of this pamphlet is available upon request to the Bronzoid Lead Corporation, 501 Magnolia Building, Dallas, Texas.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# Development of Manganese-Molybdenum Steel for Valves and Fittings for the Oil Industry

By

A. C. GREGG

Metallurgist of Kerotest Manufacturing Co.

THE material and workmanship used in the manufacture of valves and fittings for the oil industry have been steadily and continuously improved during the past 15 to 20 years. The development work underlying this improvement was undertaken by progressive valve manufacturers in response to the increasingly exacting demands made by the users of valves, which in turn were a result of the growing severity of the service. As deeper and still deeper wells have been drilled and working pressures have been constantly getting higher, there has been a necessary evolution of the material used for valves from cast iron to semi-steel—from semi-steel to cast steel, and finally from cast steel to alloy steel.

About 15 years ago the Kerotest Manufacturing Company of Pittsburgh made the first large cast-steel valve for oil field service. Prior to that time cast iron and semi-steel were the materials commonly used. This valve was to 12-in. size, weighed 2400 lb. and was tested at 4000 lb. pressure per sq. inch. It replaced a 12-in. cast-iron valve that weighed 8000 lb. and that was subjected to a test pressure of only 2500 lb. per sq. inch. During the early days of the steel valve, the only specification was that it be made of cast steel. This is interesting when compared with the intricate and exacting requirements for steel valves of the present day.

The replacement of cast iron by cast steel was a logical development, because of the possibility offered by steel for a great reduction in weight accompanied by increased strength and especially by increased toughness and resistance to shock. Other, and by no means insignificant, factors were the increased safety to workmen afforded by the use of steel, and the fact that in case of fire the danger of cracked and ruined equipment was materially minimized.

The ductility of cast iron and of its near relative semi-steel is almost nil. The strength and shock resistance of both metals are very low. Ordinary cast steel, even in the "as-cast" condition, has three to four times the tensile strength of cast iron, and twice that of the semi-steel of 15 years ago. It has 15 to 20 times the shock resistance of either metal.

The physical properties and structures of .30 carbon cast steel are shown in Fig. 1 in four typical conditions: A—"As-cast"; B—Fully Annealed; C—Normalized and tempered; and D—Quenched and tempered.

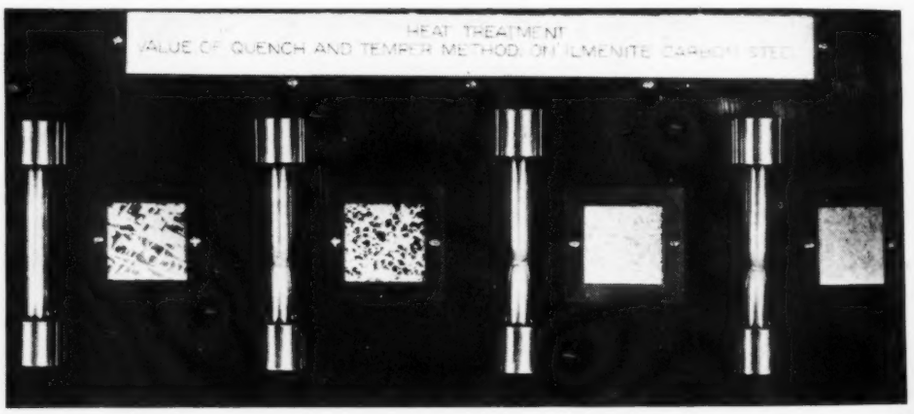
A study of the figures for physical properties shows the following comparisons of interest.

*Tensile Strength.* The "as-cast" bar has a breaking strength of 75,000 lb. per sq. in., which is changed very little by either annealing or normalizing. The quenched and tempered bar shows a tensile strength of 84,750 lb. per sq. in., which is 13 per cent higher than the "as-cast" specimen.

*Yield Point.* The yield point of the "as-cast" bar is 38,800 lb. per sq. inch. Both annealing and normalizing treatments increase this to approximately 43,500 lb. per sq. in., which is a 12 per cent improvement. The quenching and tempering treatment raises yield point to 60,850 lb., which is 57 per cent better than the "as-cast" condition.

*Elongation.* The annealed and the quenched and tempered

Fig. 1

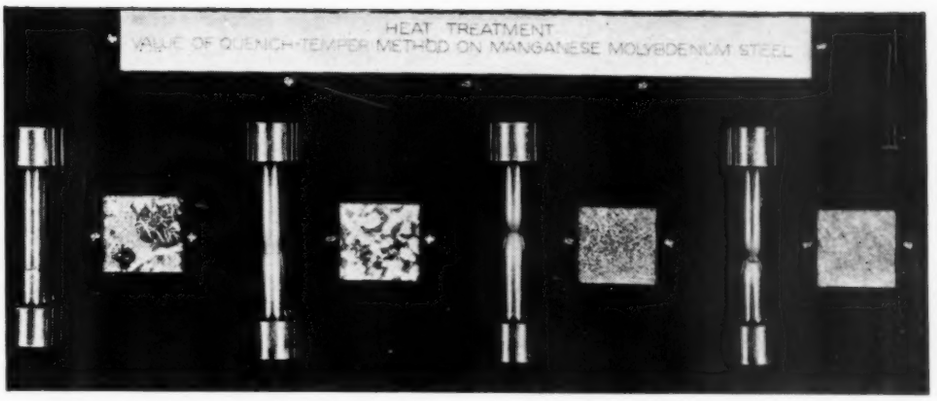



| (A)—AS CAST | | (B)—ANNEALED | | (C)—NORMALIZED AND TEMPERED | | (D)—QUENCHED AND TEMPERED | |
|---|---|---|---|---|---|---|---|
| Tensile strength—lb/sq. in. | 75,000 | Tensile strength—lb./sq. in. | 76,400 | Tensile strength—lb./sq. in. | 73,650 | Tensile strength—lb./sq. in. | 84,750 |
| Yield point—lb./sq. in. | 38,800 | Yield point—lb./sq. in. | 43,600 | Yield point—lb./sq. in. | 43,700 | Yield point—lb./sq. in. | 60,850 |
| Elongation—Per cent | 22.5 | Elongation—Per cent | 26.0 | Elongation—Per cent | 31.5 | Elongation—Per cent | 26.5 |
| Reduction of area—Per cent | 26.1 | Reduction of area—Per cent | 46.0 | Reduction of area—Per cent | 62.0 | Reduction of area—Per cent | 60.0 |
| Brinell | 156 | Brinell | 143 | Brinell | 143 | Brinell | 180 |
| Impact—Izod—ft-lb. | 17.0 | Impact—Izod—ft-lb. | 21.0 | Impact—Izod—ft-lb. | 34.1 | Impact—Izod—ft-lb. | 41.0 |
| Impact—Charpy—ft-lb. | 12.8 | Impact—Charpy—ft-lb. | 16.5 | Impact—Charpy—ft-lb. | 23.4 | Impact—Charpy—ft-lb. | 26.0 |
| Endurance ratio | 0.40 | Endurance ratio | 0.44 | Endurance ratio | 0.47 | Endurance ratio | 0.50 |

**PROPERTIES BY QUENCH AND TEMPER**

| | |
|---|---|
| Tensile strength—lb./sq. in. | 80,000 to 125,000 |
| Yield point—lb./sq. in. | 50,000 to 97,000 |
| Elongation—Per cent | 31.0 to 10.0 |
| Reduction of area—Per cent | 65.0 to 18.0 |
| Brinell | 155 to 250 |
| Impact—Izod—ft-lb. | 48.0 to 15.0 |
| Impact—Charpy—ft-lb. | 30.0 to 9.0 |
| Endurance ratio | 0.50 |

Fig. 2




| (A)—AS CAST | | (B)—ANNEALED | | (C)—NORMALIZED AND TEMPERED | | (D)—QUENCHED AND TEMPERED | |
|---|---|---|---|---|---|---|---|
| Tensile strength—lb./sq. in. | 105,500 | Tensile strength—lb./sq. in. | 92,600 | Tensile strength—lb./sq. in. | 44,950 | Tensile strength—lb./sq. in. | 106,410 |
| Yield point—lb./sq. in. | 68,150 | Yield point—lb./sq. in. | 53,900 | Yield point—lb./sq. in. | 60,300 | Yield point—lb./sq. in. | 85,780 |
| Elongation—Per cent | 11.0 | Elongation—Per cent | 27.0 | Elongation—Per cent | 23.5 | Elongation—Per cent | 22.6 |
| Reduction of area—Per cent | 11.9 | Reduction of area—Per cent | 45.8 | Reduction of area—Per cent | 52.8 | Reduction of area—Per cent | 54.6 |
| Brinell | 207 | Brinell | 170 | Brinell | 187 | Brinell | 203 |
| Impact—Izod—ft-lb. | 12.0 | Impact—Izod—ft-lb. | 18.0 | Impact—Izod—ft-lb. | 42.6 | Impact—Izod—ft-lb. | 54.0 |
| Impact—Charpy—ft-lb. | 17.5 | Impact—Charpy—ft-lb. | 17.8 | Impact—Charpy—ft-lb. | 33.3 | Impact—Charpy—ft-lb. | 37.0 |
| Endurance ratio | .40 | Endurance ratio | .44 | Endurance ratio | .47 | Endurance ratio | 0.53 |

**PROPERTIES BY QUENCH AND TEMPER**

| | |
|---|---|
| Tensile strength—lb./sq. in. | 90,000 to 187,000 |
| Yield point—lb./sq. in. | 65,000 to 179,000 |
| Elongation—Per cent | 25.0 to 10.0 |
| Reduction of area—Per cent | 58.9 to 25.0 |
| Brinell | 183 to 430 |
| Impact—Izod—ft-lb. | 59 to 3 |
| Impact—Charpy—ft-lb. | 40 to 2 |
| Endurance ratio | .53 |

bars show an improvement over the "as-cast" condition of about 18 per cent. The normalized bar is about 31 per cent higher than the "as-cast."

*Reduction of Area.* This property is important as an indication of ductility. The annealed bar shows an improvement over the "as-cast" of 75 per cent. Both the normalized and the quenched and tempered bars have figures 134 per cent higher than the "as-cast" and 30 per cent higher than the annealed specimen.

*Impact Test.* Resistance to shock is determined by two well-known impact tests — Izod and Charpy. Both tests give the same information. These dynamic shock tests are probably the most interesting of all the tests made. For the "as-cast" bar the Izod test shows a resistance to shock of 17 foot-pounds. The annealed bar shows 21 ft-lb., which is an improvement of 23.5 per cent. The normalized and tempered result is 34.1 ft-lb., or 100 per cent better than the "as-cast", while the quenched and tempered bar shows a figure of 41 ft-lb., or 141 per cent better. The quenched and tempered bar is 95 per cent more shock-resistant than the annealed specimen.

Resistance to shock (or toughness) and high tensile strength are properties opposed to one another. The metallurgist is forever seeking the steel and the treatment that will produce the highest possible strength with the highest possible toughness. In selecting the steel for any given application, it is necessary to select the best possible compromise between toughness and strength to meet the particular application in question. If toughness be more important than strength or hardness, the treatment must be such as to produce a low Brinell figure. If hardness be the more important requirement, and the accompanying lack of toughness can be disregarded, the steel should be treated to produce a Brinell figure as high as possible.

Valve steel must have very high strength to withstand stretch, but it is also absolutely essential that it be tough and shock-resistant to meet the sudden strains put upon it in service. The practical limits for hardness in a carbon-steel valve lie between 150 and 180 on the Brinell scale. This represents a tensile strength between 75,000 and 90,000 lb. per sq. in., (or say a mean of 82,000 to 84,000 lb. per sq. inch). With this tensile strength, carbon steel properly heat-treated will show a figure of 40 to 42 ft-lb. Izod.

It is easy to understand why cast steel replaced cast iron as the material used for valves, but carbon cast steel with all its excellent combinations of properties does not satisfy all the present day demands of valve users.

By the introduction of *alloys*, it is possible to produce steel having greater strength for a given ductility, or greater ductility for a given strength than is possible with the best made carbon steel; also, as a rule, alloy steels have greater resistance to wear and abrasion.

There are five alloys in general use today for the production of Pearlitic and Sorbitic alloy steels, namely: Nickel, Molybdenum, Chromium, Vanadium, and Manganese. The various combinations of these alloys make possible a surprisingly

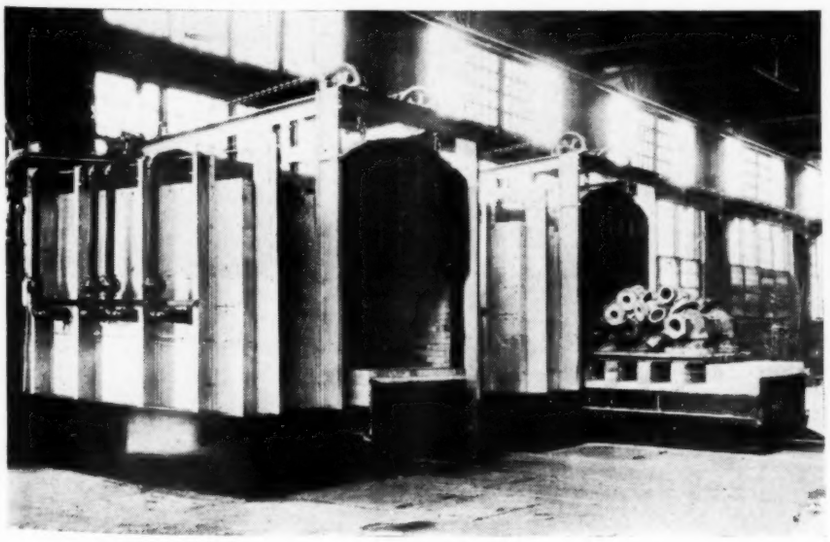


Fig. 3. Modern heat-treating and annealing furnace

*Removing the Nose Plug by hand from the Outer Case after taking a reading.*

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**Survey Instrument**

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large number of alloy steels adaptable for castings.

The value of Molybdenum as an alloy for steel castings was not recognized prior to 1922. The first use of this element as an alloy for steel was in combination with tungsten and chromium in relatively large percentages, for the manufacture of high-speed steel.

Molybdenum's valuable service in imparting impact resistance was recognized during the World War in the manufacture of steel for use in heavy field artillery. Modern high explosives demand the utmost in shock resistance of the steel used to manufacture guns, and Molybdenum Alloy steel (heat-treated) has proved the best answer to this problem.

The Kerotest Manufacturing Company, after experimenting with many different types of alloy steel adopted Manganese-Molybdenum as its standard early in the year 1922. The application of Molybdenum as an alloy for steel valve castings was pioneered by this company. The first Molybdenum heat was made in January, 1922, and its analysis was Carbon .20, Molybdenum .27, Manganese .43. The castings and test bars were only annealed but showed sufficiently good physical properties to warrant further trials. Many heats with

**Fig. 4. Photomicrograph of "As-Cast" structure of M. M. alloy steel**

**Fig. 5. Photomicrograph of Annealed structure of M. M. alloy steel**

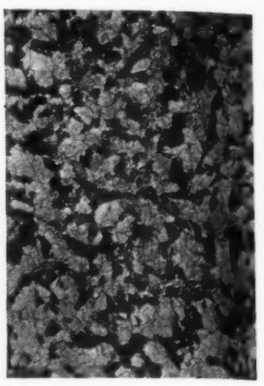

**Fig. 6. Photomicrograph of Normalized and Tempered structure of M. M. alloy steel**



**Fig. 7. Photomicrograph of special heat treatment of structure of M. M. alloy steel**



varying percentages of Carbon, Molybdenum, and Manganese were then made and the result of this series of experiments was to standardize the combination now known as Manganese-Molybdenum or M. M. steel.

When the first heats of Molybdenum steel were made, annealing was the usual treatment for steel castings. Annealing at that time was not under the exact control that exists today because furnace and pyrometer equipment was vastly inferior to that now in use. Fig. 3 illustrates the modern heat-

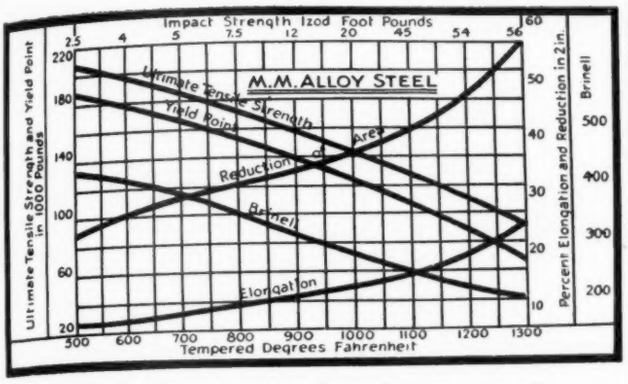


**Fig. 8. Chart showing physical properties of M. M. alloy steel**

treating and annealing furnace in use today. Doors and cars are operated by push buttons, and temperatures are regulated by automatic recording control pyrometers. Furnaces are heavily insulated and the furnace atmospheres so regulated as to insure uniform heating throughout the load. Handling the hot castings from furnace to quenching tank is accomplished by a crane carrying an automatic latch, which permits the transfer with a minimum loss of temperature.

But annealing, however well performed, fails to produce the best combination of physical properties for Manganese-Molybdenum or any other Pearlitic alloy steel. Normalizing followed by a tempering treatment was the next improvement, and the physical results so produced are very much superior to those for annealed steel; however, as has already been shown in discussing carbon steel, the maximum combination of shock resistance and high tensile strength was arrived at only by full heat-treatment. That is, by liquid quenching from a temperature just above the critical range, followed by a tempering or draw-treatment just below this range.

Fig. 2 shows the physical properties and structures of cast Manganese-Molybdenum steel in four typical states: A—"As-cast"; B—Annealed; C—Normalized and tempered; D—Quenched and tempered. Figs. 4, 5, 6, and 7, illustrate better the micro-structures and the progressive refinement in grain structure from "as-cast" to the annealed, to the normalized, and to the quenched and tempered state. The structure shown in Fig. 7 is produced by a liquid quench followed by a tempering treatment at 1250 deg. fahrenheit. The chart shown in Fig. 8, shows the variation in physical properties that can be accomplished with Manganese-Molybdenum steel if the tempering treatment be varied from 500 deg. fahr. to 1300 deg. fahrenheit.

A study of the figures shown in Fig. 2 reveals the superior properties of Manganese-Molybdenum steel, and the effects of various heat treatments upon structure and physical properties.

*Tensile Strength.* The "as-cast" bar has a tensile strength of 105,500 lb. per sq. inch. This is lowered 12 per cent by annealing and 10 per cent by normalizing but is increased to 106,400 lb. per sq. in. by quenching and tempering.

*Yield Point.* Yield point has greater importance than tensile strength when placing a valuation on the properties of a steel, because a steel that has been stressed beyond its yield point is ruined and fit for nothing but remelting.

The yield point of the "as-cast" bar is 68,150 lb. per sq. inch. This is lowered 21 per cent by annealing and 11.5 per cent by normalizing, but is increased to 85,780 lb. per sq. in. by quenching and tempering, or almost 60 per cent better than the annealed bar.

*Elongation.* Elongation in the "as-cast" M. M. bar is 11.0


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This strong compact wiper is designed to fit *all* LUFKIN Oil Gagers Tapes. Can be attached to tapes now in the field, or to obtain it on new tapes, order them "With 599 Wiper." Small pads, on which the tension is regulated by a thumb screw, wipe oil from line as it is being rewound.

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THE LUFKIN RULE CO.
SAGINAW, MICH.


per cent, which is increased to 27.0 per cent by annealing, and shows 23.5 per cent and 22.6 per cent, respectively, in the normalized and the quenched and tempered bars.

*Reduction of Area.* The "as-cast" bar shows 11.9 per cent reduction of area. Annealing increases this to 45.8 per cent —normalizing to 52.8 per cent—and quenching and tempering to 54.6 per cent.

*Impact Test.* As was the case with carbon steel, the most gratifying and significant improvement accomplished by heat treating is revealed by the impact test results. In the "as-cast" condition M. M. steel shows only 12 ft-lb. by the Izod test. The annealed bar shows 18 ft-lb., which is a 50 per cent improvement; the normalized bar shows 42.6 ft-lb. or 255 per cent better than the "as-cast" bar; the quenched and tempered bar shows 54.0 ft-lb. or 350 *per cent improvement over the "as-cast" bar, and* 200 *per cent better than the annealed specimen.*

The practical limits for hardness in alloy steel valves lie between 200 and 225 on the Brinell scale. This represents a tensile strength somewhere between 100,000 and 110,000 lb. per sq. inch. With tensile strength at this figure Manganese-Molybdenum steel heat-treated has the unusually high figure of 54 ft-lb. Izod.

Aside from the unusual combination of high tensile strength and resistance to shock found in Manganese-Molybdenum steel, there are many reasons for its adoption as an ideal alloy steel for the manufacture of valves and fittings. As compared to chromium or nickel steels or chrome-nickel steel, it is less likely to contain checks and internal tears and shrinkage defects not discernible by surface inspection.

During the melting and refining operations, Molybdenum does not oxidize and consequently the Molybdenum content of a bath of metal can be controlled with certainty. This fact assures the proper percentage in the melt and in all parts of the castings.

The improvement in the material used for valves has gone hand in hand with improvements in workmanship in foundry and machine shop. Valve castings today must leave the foundry with a minimum of machine finish, and must be cleaned and ground until free of all adhering sand and surface defects. Cores must clean out of castings, leaving smooth perfect surfaces. Great ingenuity has been exercised and in the study of heading, gating, and chilling to produce valve castings that are free from shrinks and internal defects of all descriptions. Improvements in heat-treating technique have been previously discussed.

In the machining of valves, jigs and fixtures are employed assuring interchangeability of all valve parts. Machine operations are held to closer tolerances, which means better fits, and all machined surfaces must have finer finishes with removal of tool marks and better workmanship in all respects than the valve of yesterday.

## New Catalog Issued by Lane-Wells Co.

The Lane-Wells Company, with headquarters in Los Angeles and branches in Houston, Tulsa, Oklahoma City, and New York, has just completed a catalog of 74 pages containing bulletins on packers, liner hangers, and gun perforator service. An interesting feature of the catalog is the exceptionally complete "applications" section in each bulletin, containing (in addition to the better known uses) information on many practical applications of each product not generally known to the industry at large.

Copies of the catalog will be sent free to production men who write to the Lane-Wells Company, 4439 Santa Fe Ave., Los Angeles, California.

## Continental Supply Company Advertising Account to Dallas

Announcement has been made from the offices of the Continental Supply Company that advertising of the company is now being handled in Dallas, Texas, by Brennan, Brown & Company, Inc. Since moving to Dallas a year and a half ago the only activity that the company had not brought to Dallas was the advertising account.

## Argentine Representative of Axelson Visits United States

John R. Webb, representative of the Axelson Manufacturing Company in Buenos Aires, Argentine, is now at the Los Angeles plant of the Axelson organization. Webb, who made the trip from Buenos Aires to New York City and from there to Los Angeles by plane, is familiarizing himself with the latest manufacturing methods and oil field procedure in both California and the Mid-Continent.

Webb, a California man, has been associated with the oil industry for many years and is well known to oil operators in the United States and foreign countries. His reports on Argentine conditions indicate a material business improvement in that part of the world's oil fields.

## Eastman Oil Tool Company, New Concern Formed by H. John Eastman

H. John Eastman has incorporated a new company to be known as the Eastman Oil Tool Company. A modern plant has been built at 2901 American Avenue, Long Beach, California, for the manufacture of deflecting tools and bits, as well as regular bits. These tools are rented direct to oil operators or furnished in connection with the services of the Eastman Oil Well Survey Company.

The officials of the new company are oil men of many years' experience. H. John Eastman, the president, is widely known for his controlled directional drilling work. R. E. Wiley, first vice-president and general manager, has been

head of the bit department of the Eastman Oil Well Survey Company. J. W. Hughes, second vice-president and sales manager, was formerly employed by the Oil Tool Exchange. Wm. C. Greene, secretary-treasurer and business manager, has had business experience in China and the Hawaiian Islands and at one time was an efficiency expert for the Westinghouse Electric and Manufacturing Company.

In discussing this new venture Mr. Eastman said, "I believe we have a line of deflecting tools and bits that will meet any demand of the oil industry."

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*Write for Catalog (B-35)*

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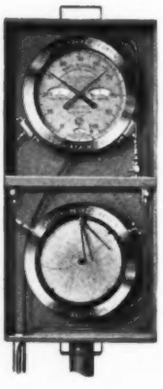
• This new Martin-Decker Weight Indicator serves as a base for their new "Quintuplex" Drilling Control Instrument which embodies Mud Pump Pressure, Torque and Rotary Table Indicators. Under most conditions, operators prefer to install the complete "Quintuplex," which gives them information on every phase of the drilling operations, but you can buy it in any combination or each instrument may be purchased separately.



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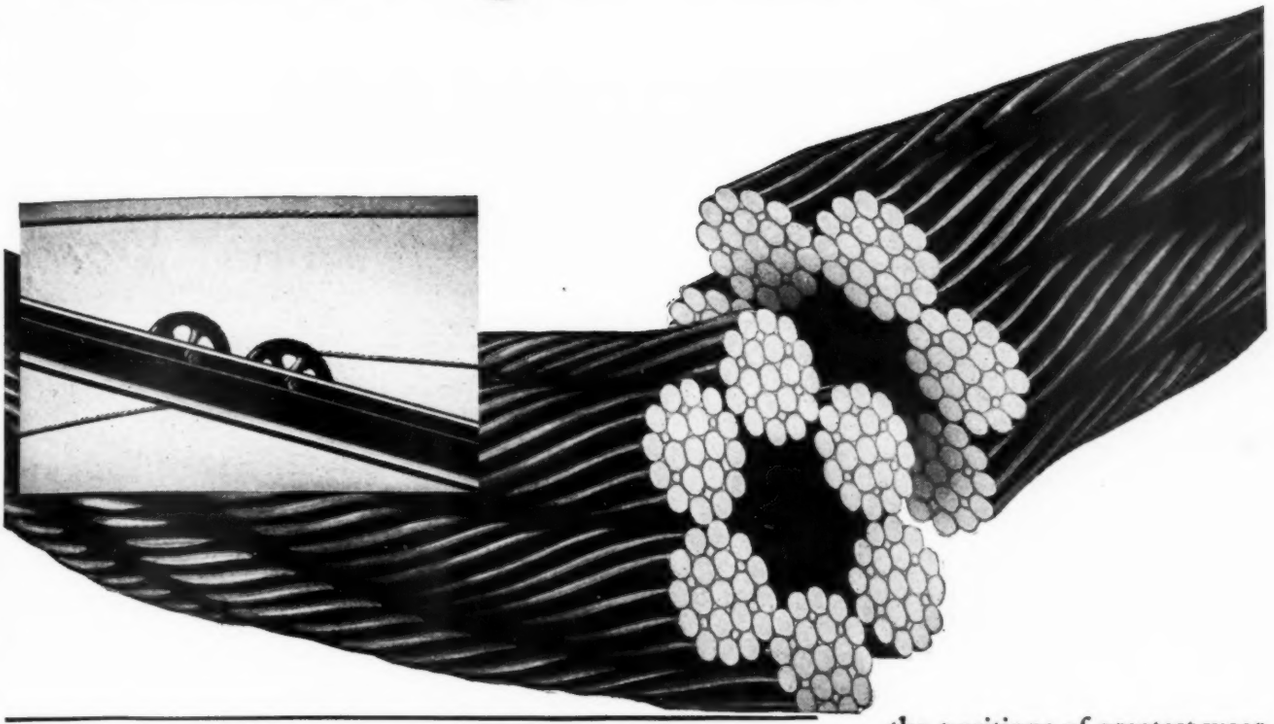

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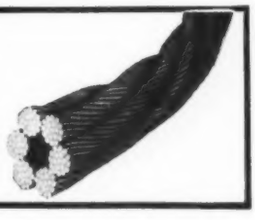
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